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TEN YEARS FOUNDATION FLORA MALESIANA TWENTY-FIVE YEARS OF WORK

by

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“There are many who give up,
and many who procrastinate, but
there are some who go on.”

C. S. FORESTER

I. INTRODUCTION (H. J. Lam)

As a phylogenist, I have often experienced that a relatively small number of scientifically working botanists realize the importance — or even the existence — of the factor time. It is true that many of them never come across that factor; for a man who through his microscope analyses the structure of a tissue, or a man who with the most delicate methods investigates the composition of organic compounds in a vacuole, the factor time is quite insignificant, as long as they keep analysing and do not ask where things come from (which they usually don't).

However, the changes which time may entail in the material investigated, are practically always interpretable in terms of reversibility or periodicity. They seldom or never evoke thoughts of a farther past than a few hours, days, or years. I have sometimes felt astonished, moreover, that even morphologists who study the ontogeny of organs to the minutest details consciously or unconsciously stop at what they cannot observe with their senses, directly or by the mediation of their instruments; the step from ontogenist to phylogenist seems to be a very wide one.

Comprehensible as this may be, owing to a hesitation to enter a field which lies beyond possible direct observation, it is obvious that that field is there and is claiming to be explored, albeit with its particular methods. It is the field of all historical disciplines whether they belong to the Humanities or to Science. Amongst the latter lies not only Phytotaxonomy but obviously also its history. If taxonomy can, to a certain extent, be studied without considering the past, digging deeper inevitably leads to both typology (as a method of logical comparison) and phylogeny. In these methods past facts, events, or forms play an ever more important

part, until, in the very history of the science in question, all material for investigation is provided by the past.

In this respect I have often thought of the following metaphors. A schoolboy might naively consider that a temperature of 30° centigrade is twice as high as one of 15°, but as soon as he is asked what the relation might be between a temperature of 30° and one of 0°, he realizes that he is thinking along wrong lines. And an experienced scientist will immediately recognize that he has to refer both sets of figures to one which falls far beyond daily experience, viz. zero Kelvin.

Similarly — and this question is much less evident and much more intricate — one might ask if a man of 70 is, in the average, twice as experienced and wise as a man of 35. Without stressing this point, or pursuing it in detail, it must be stated that this is obviously not so, which must mainly be due to the fact that most of the present experience and wisdom (or their genetically fixed bases) of the individual has been gradually built up during an enormous past, properly speaking dating back as far as the origin of life on earth; built up during phylogeny, not ontogeny.

The same reasoning is applicable to the development of such a great enterprise as FLORA MALESIANA, whose roots reach far into the past. One need not go back as far as *Pithecanthropus erectus* — although this creature has undoubtedly played its part in it — or even Marco Polo, to state that the beginning was both vague and slow. But it seems that the process — as is the usual course of things — having gradually gained purpose and outline was quickening at a geometrical pace. The first collections 'on purpose' date from the late 16th century, and they were the commencement of an enormous number of followers, but their treatment long remained haphazard. The first ideas on a comprehensive overall FLORA MALESIANA rose just over a hundred years ago in the minds of the Swiss botanists Zollinger and Moritzi (1845)¹), who coined the name which has now been effectually immortalized in the tremendous work which started its publication in 1948. The ambitious Swiss plan was, however, never carried out, and the 'Flora's only true predecessor was Miquel's "Flora Indiae Batavae" (1855—1859). However valuable in its time, this now appears to be a rather uncritical compilation of random data from a vaguely delimited area. It may be called a predecessor, not a precursor, because the purpose was quite different. For it is one thing to collect facts, and another to put them aptly together into a lasting form, which will retain its value for a very long time. It requires not only the availability of facts and data, it above all requires the right man in the right place and at the right time; a man not only with experience and insight but with pluck and self-confidence to start a task which will possibly outlive him, a strong will, nay, possessedness to persevere and to succeed against unexpected odds, and a great enthusiasm; a man who inspires others by his example and overcomes set-backs by his tenacious assiduity. A man of these combined qualities is CORNELIS GLJSBERT GERRIT JAN VAN STEENIS, Editor-in-chief of Flora Malesiana, Director of the Foundation, and Professor

¹) Cf. H. J. Lam, On a forgotten floristic map of Malaysia (H. Zollinger, 1857) — Blumea Suppl. 1 (1937) 176—182, with map.

of Tropical Botany of the municipal University of Amsterdam and the State University at Leiden. It may safely be said that this man by now ranks amongst the greatest systematists and botanical organizers of our time. If the late Dr E. D. Merrill was given the honourable title of the American Linnaeus, Van Steenis might deserve that of the 'Malaysian Merrill' were it not that he, I think, has surpassed that eminent American botanist by the quality of his creation: FLORA MALESIANA.

Two other circumstances have considerably contributed to what now may be safely called the success of Flora Malesiana. However plentiful the available facts, however capable the man to work with them, he could not have yielded the achievements we are now able to judge about and admire, without being given the opportunity of nestling in the proper niche, to use a very adequate ecological term. His proper and almost ideal niche he found both at the Herbarium at Buitenzorg (Bogor) and later at that of Leiden, but above all in the fascinating nature of 'India Aquosa', which it was his privilege to explore intensively. Again, he would not have been able to achieve what he did without the immensely valuable help of so understanding, industrious, and expert a life-companion as it was Van Steenis's good fortune to have found in his wife, who co-operated and co-operates with her husband in perfect harmony.

And, I must not refrain from inserting at this place of the context, the happy and capable co-workers it was his privilege to attract and keep attached, bound to him as they are by bonds of sympathy and admiration, wishing to be taught and to play a rôle in the construction of a huge building. This is a good team, working under a spirited leader, and co-operating in mutual esteem with that other team, the staff-members of the Tropical Plants Department of the Rijksherbarium.

For honesty's sake I cannot forbear from stating that this man — like every-one of us — has to bear the burden of the 'fautes de ses qualités'. For I have always deemed it unworthy of a man of quality, when sketching his personality, to mention his better qualities only, because particularly such a man is entitled to be fully pictured as the human being he is.

Fortunately it can be stated that most of Van Steenis's shortcomings are harmless and even disarming in their naive unintendedness, and these are easily pardonable since they are greatly compensated by his outstanding merits. They are typical for the mind which aims at a great and distant goal, a condition which often entails a certain lack of consideration for other people's feelings.

Less harmless, though equally rooting in perfectly honest intentions and based upon the high standard he demands of himself, is sometimes the wording of his criticism of other people's work and personalities. There is no doubt not the slightest intention to offend and I think he does not even suspect that these words may be hurting, for they are always spoken or written in a sense of perfect objectivity. Yet, it has been observed that his critical remarks are sometimes clad in unnecessarily strong terms which may tend to hurt the person criticized, even up to the point of rebuffing him and cutting off his good-will to co-operate. However understandable in a man of strong intentions, and however unwittingly expressed, it is not justified, I think, to expect the same high

standard of work in others who are less gifted in those points in which the critic is a master himself. Due consideration of others people's intellectual limits requires a certain tolerance as long as the criticized has loyally worked to the best of his abilities.

These, I imagine, are the main factors which played and play a part in the origin, the start, and the pursuance of *Flora Malesiana*.

These lines are being written on the occasion of the tenth anniversary of the Foundation. But just as the earliest origin of the work lies hidden in a remote past, the actual beginning took place long before the enterprise was given an official status in the Foundation.

Van Steenis will celebrate his 59th birthday only ten days after his Foundation started its second decade. He is now at the acme of his life, his organisation is in full swing, it has met with world-wide recognition, approval and admiration. And as the writer of these lines approaches the age of retirement as a professor of botany and a director of the 'Rijks-herbarium', he is only too eager to avail himself of this opportunity to express his feelings of warm friendship and genuine esteem, to which may be added his confidence in the future and his very best wishes for the ultimate completion of what has aptly been termed "a tremendous undertaking", and "one of the most notable botanical enterprises of the present century".

The idea of composing a flora for the whole of 'Malaysia' — a term coined in this orthography by E. D. Merrill, if I well remember — seems to have risen in Van Steenis's mind early in his tropical years. Having obtained his doctor's degree in 1927, he came to Java in the same year and immediately tackled the local flora with all the enthusiasm of a 'possessed' mind. Although he himself states (F. M. I, 1, p. XI) that the actual work, or the work along the intended lines, started in 1935 — and would therefore now be in its 25th year — certain publications of an earlier date (e. g. Origin of the Malaysian Mountain Flora 1934, and even his dissertation of 1927 on the Malaysian Bignoniaceae) show that the idea of composing a comprehensive flora of a region with, phytogeographically speaking, natural boundaries, slumbered in his mind soon after his arrival in Java in 1927 and took more and more shape in the early thirties.

In the second chapter of this paper, compiled by his staff-member Dr P. W. Leenhouts, the reader will find some general information about what has been accomplished in the last 15 years or so. It not only mentions the main contents of the *Flora* proper, but also the many precursory studies, part of the contents of the "*Flora Malesiana Bulletin*", the "*Identification Lists of Malaysian Specimens*", and the quite recent "*Miscellaneous Records*".

The number of precursory studies is far greater than the odd 25 published in the series "*Florae Malesianae Praecursores*". These papers are primarily intended to give information which cannot be included in the *Flora Malesiana* proper: revisions which go far beyond the Malaysian boundaries, descriptions of new taxa, collections, and general remarks. Not rarely they give, when combined with the treatment in *Flora Malesiana*, a complete revision of the group concerned. Many of these precursory papers are freely distributed to about 70 herbaria and individual botanists all over the world.

The "Flora Malesiana Bulletin", now comprising 15 numbers with nearly 800 pages, bound into firm dark brown covers and adorned with the reproduction of some memorable photographs, has developed into a tremendously rich source of miscellaneous information. It is mainly issued on behalf of the co-operators and distributed among more than 250 institutes and private persons all over the world.

Of the "Identification Lists" 10 have been issued up to date. Decorated with a witty picture on the simple paper-cover in a light green shade they give full information about identifications of collections as soon as the treatment of a taxon is completed, in case these have not been quoted in a precursory paper. They are distributed to about 60 herbaria where Malaysian collections are preserved.

Finally, the most recent addition to the 'service' offered by Flora Malesiana for both internal and external purposes, is the edition of the "Miscellaneous Records". The first of these (1959) contains a preliminary revision of the genus *Kopsia* (Apoc.). The intention of this series is to give preliminary mimeographed revisions of groups, the knowledge of which is still far too insufficient to allow definite publication; by publishing these, however, it is hoped to evoke co-operation so as to get a better insight in the problems, to obtain more complete collections, and thus to ease a final revision in a near future.

The Flora proper begins to show nicely. Three sturdy volumes (1, 4 and 5 of Series I) of some 800—1000 pages each and the first instalment of Series II (Ferns) are the remarkable result of twenty-five years of work of Van Steenis, his team, and his growing school.

This Flora is unique in many ways. Never, so far as I am aware, has a tropical flora been so thoroughly prepared and so efficiently edited. The general chapters already published offer a wealth of information which serves both as an introduction and a summary to what is following in the special part. Mrs. Van Steenis's "Cyclopaedia of Collectors" (Vol. 1) has been given due praise from all parties interested. Like Backer's "Verklarend Woordenboek", it is an unrivalled source of information of many kinds, notably historical. Comprising over 600 pages and numerous portraits, some of which it took great pains to lay hands on, the Cyclopaedia has been supplemented in Vol. 5 (almost 100 pages). In that same Volume there is a chapter from Mrs. Van Steenis's hand, dealing with "Citation of serials and some books" (± 20 p.), and Vol. 4 of Series I contains interesting data on "Dates of publication" by Mrs. Van Steenis and W. T. Stearn (57 p.).

These important studies are supplemented by H. C. D. de Wit's concise and very nicely written "History of the Phytography of Malaysian Vascular Plants" in Vol. 4 (± 90 p.), illustrated by numerous small-size portraits, several of which are not found in the Cyclopaedia.

The rest of the General Chapters have been very ably and circumstantially written by Van Steenis himself. They deal in Vol. 1, 4, and 5 with numerous topics pertaining to exploration, collecting, publication, bibliography, taxial delimitation, taxonomical methods, life-forms, distribution, ecology, etc., comprising some 550 pages in all, most of these items being amply illustrated by pictures and maps. Extensive additions of this

type are in store and some of these will be published in a near future. They will deal with vegetation (Vol. 2) and with plant-geography (Vol. 3).

Regarding the special part of the Flora, the core of the work, it may be stated that it represents a very well balanced account of the taxa living in the area concerned. Outstanding merits are that it is largely original work; practically all quotations have been carefully checked in order to avoid longevity of errors and mistakes; of practically all basionyms the type specimens have been consulted; accordingly, nomenclature has been cleared up and brought up to date as far as possible; of many endemic or sub-endemic families and genera, the Flora contains what with confidence can be called monographs; for many of these material outside the Malaysian area has been consulted, so that large parts of the flora's of e. g. Thailand, North Queensland, and the Pacific Islands as far east as Fiji and Samoa, to a lesser extent also those of Farther India, Southern China with Hainan, and the Deccan Peninsula, have undergone a revision; by far the greater part of the illustrations — the line-drawings by the very able hand of the Foundation's artist, miss Ruth van Crevel — are original, and many species are figured here for the first time.

Finally, I deem it the proper place and opportunity here to announce the forthcoming start of a related series of publications under the title of "Pacific Plant Areas". The writer of these lines being the initiator of this project at the Sixth Pacific Science Congress at Berkeley, California, in 1939, the working-out lingered for many years, happily surviving through three more congresses, until the very people to get it well under way, Dr and Mrs Van Steenis, at my suggestion put their shoulders under it. The combination of their organisatory talents, hard work, and helpful relations, resulted in the production of a voluminous first part, containing an introduction to the scheme of the work, an extensive bibliography, and a first instalment of 26 maps. This will, with the kind mediation and co-operation of Dr Eduardo Quisumbing of Manila, P. I., be published as a Monograph of the Institute of Science and Technology, Manila, and will come from the press in the beginning of next year. The purpose is to publish area-maps of genera and other well-defined taxa. These maps are based upon carefully selected material of a monographic nature and each of them will be accompanied by a short elucidating text. It is hoped that, in the long run, these maps will form a useful companion to the Flora, even if Pacific rather than Malaysian taxa will be treated.

Whereas we may, for more detailed information, refer the reader to the next pages, we may state that we, of the Rijksherbarium, are proud of having Van Steenis and his staff in our midst. Offering him our hearty congratulations on the first twenty-five years of his fruitful activities, we express the hopes that he will live to see through the next twenty-five and see, perhaps, his "Magnum Opus" completed. If he is given as long a life as Dr H. N. Ridley — who died some years ago in his 101st year — there is a good chance that he will witness that epoch-making event.

II. THE RESULTS (P. W. Leenhouts)

The following pages contain a systematic bibliography of all scientific papers, either

1. published in *Flora Malesiana*, or
2. being precursory to *Flora Malesiana*, or
3. definitely stimulated by *Flora Malesiana*.

The total number of publications cited in this bibliography amounts to more than 450, printed on about 8000 pages, and illustrated by ± 1600 figures and plates, besides a great number of portraits.

General parts

General subjects

- C. G. G. J. VAN STEENIS, Introduction — *Flora Malesiana* I, 4 (1948) V—XII, f. 1.
 —, General considerations — *Flora Malesiana* I, 4 (1948—1949) XIII—LXIX, f. 2—49.
 —, The technique of plant collecting and preservation in the tropics — *Flora Malesiana* I, 1 (1950) XLV—LXIX, f. 1—19.
 —, Redaction of Floras — 8th Int. Bot. Congr. Paris sect. 2—6 (1954) 59—66.
 —, Diatoms as tracers to localize erroneously labelled specimens — *Taxon* 5 (1956) 157—158.
 —, Specific and infraspecific delimitation — *Flora Malesiana* I, 5 (1957) CLXVII—CCXXXIV, f. 1—7.
 —, Specific delimitation, with special reference to tropical plants — *Uppsala Un. Arsskr.* 6 (1958) 120—127.
 A. VAN DER WERFF, Diatoms as a means for identifying the origin of aquatic plants — *Blumea* 7 (1954) 599—601.

History

- S. J. VAN OOSTSTROOM & C. G. G. J. VAN STEENIS, Contributions to the history of botany and exploration in Malaysia 2. Keuleman's collection from "Prinsen-eiland" (Java) is an unknown collection of plants from I. do Principe (West Africa) — *Bull. Jard. Bot. Btzg* III, 18 (1950) 466—468.
 C. G. G. J. VAN STEENIS, Account of Javan plants collected by C. F. Hornstedt in 1783—1784 — *Acta Horti Berg.* 15 (1949) 39—43, f. 1.
 —, Contributions to the history of botany and exploration in Malaysia 3. Collection of Philippine plants of M. Blanco at Geneva — *Bull. Jard. Bot. Btzg* III, 18 (1950) 468.
 —, *Thesaurus Beccarianus* — *Webbia* 8 (1952) 427—436.
 C. G. G. J. VAN STEENIS & M. J. VAN STEENIS—KRUSEMAN, *Cyclopaedia of collectors* — *Flora Malesiana* I, 1 (1950) I—CLII, 1—639, f. 1—26, map 1—3, 70 facsimiles of handwritings, a great number of portraits.
 —, Contributions to the history of botany and exploration in Malaysia 4. Collection "Stathouder, Java" at Paris comes from Ceylon — *Bull. Jard. Bot. Btzg* III, 18 (1950) 468—470.
 —, *ditto* 5. Biographical note on Alexander Zippelius — *Bull. Jard. Bot. Btzg* III, 18 (1950) 470—471.
 —, Brief sketch of the Tjibodas Mountain Garden — *Fl. Mal. Bull. no.* 10 (1953) 312—351, pl., ground-plan.
 C. G. G. J. VAN STEENIS, M. J. VAN STEENIS—KRUSEMAN & C. A. BACKER, Louis Auguste Deschamps — *Bull. Br. Mus. Nat. Hist. Historical series* 1 (1954) 49—68, pl. 13.
 M. J. VAN STEENIS—KRUSEMAN, Contributions to the history of botany and exploration in Malaysia 1. Kollmann's collection of Javan plants — *Bull. Jard. Bot. Btzg* III, 18 (1950) 463—466.
 —, Malaysian plant collectors and collections, Supplement I — *Flora Malesiana* I, 5 (1958) CCXXXV—CCCXLII, with many portraits.
 M. J. VAN STEENIS—KRUSEMAN & C. G. G. J. VAN STEENIS, Contributions to the history

of botany and exploration in Malaysia 6. Did Zollinger ever visit the Krakatoa Islands? — Bull. Jard. Bot. Btzg III, 18 (1950) 471—472.

- H. C. D. DE WIT, Johan Baptist Spanoghe — Chron. Naturae 104 (1948) 206—209.
 —, Short history of the phytography of Malaysian vascular plants — Flora Malesiana I, 4 (1949) LXX—CLXI, map, many portraits.
 —, Contributions to the history of botany and exploration in Malaysia 7. Report on the botany of Leti and the southern Moluccas (1712—1720) by E. C. Barchewitz — Reinwardtia 1 (1951) 67—73, f. 1.

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 —, Annotated selected bibliography — Flora Malesiana I, 5 (1955) I—CXLIV.
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 —, Dates of publication and bibliographical notes — Fl. Mal. Bull. no. 12 (1956) 488—491.
 —, Citation of serials and some books — Flora Malesiana I, 5 (1956) CXLV—CLXV.
 —, Dates of publication and bibliographical notes — Fl. Mal. Bull. no. 13 (1957) 568—570.
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 M. J. VAN STEENIS—KRUSEMAN & W. T. STEARN, Dates of publication — Flora Malesiana I, 4 (1954) CLXIII—CCXIX.
 H. C. D. DE WIT, Dates of publication of Malaysian phytotaxonomical literature — Fl. Mal. Bull. no. 6 (1950) 164—168.
 H. C. D. DE WIT *et al.*, Dates of publication of Malaysian phyto-taxonomical literature — Fl. Mal. Bull. no. 4 (1948) 96—99.

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 C. KALKMAN, A plant-geographical analysis of the Lesser Sunda Islands — Acta Bot. Neerl. 4 (1955) 200—225, f. 1—2.
 C. G. G. J. VAN STEENIS, Hoofdlijnen van de plantengeografie van de Indische Archipel op grond van de verspreiding der Phanerogamengeslachten — Tijdschr. Kon. Ned. Aardr. Gen. 65 (1948) 193—208, f. 1—7.
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- , Condition and cause in ecological interpretation — Blumea Suppl. 4 (1958) 93—95.

Taxonomic papers

BRYOPHYTA

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- , Precursory studies in Malaysian Mosses I. Revision of the genus Dawsonia R. Brown — Rev. Bryol. Lich. 26 (1957) 8—19, f. 1—6.
- , *ditto* II. A preliminary key to the Moss genera — Blumea 9 (1958) 143—186.
- B. O. VAN ZANTEN, Trachypodiaceae. A critical revision — Blumea 9 (1959) 477—575, pl. 1—12.

PTERIDOPHYTA

- A. H. G. ALSTON, Some undescribed ferns from New Guinea and Ambon — Nova Guinea n.s. 7 (1956) 1—3.
- , Isoëtaceae — Flora Malesiana II, 1 (1959) 62—64, f. 1.
- A. H. G. ALSTON & R. E. HOLTUM, Notes on taxonomy and nomenclature in the genus Lygodium (Schizaceae) — Reinwardtia 5 (1959) 11—22.
- P. R. BELL, Elaphoglossum decurrens (Desv.) Moore in Southeast Asia — Kew Bull. (1960) 79—84.
- R. E. HOLTUM, Further notes on the fern-genus Heterogonium Presl — Reinwardtia 1 (1950) 27—31.
- , The fern-genus Pleocnemia — Reinwardtia 1 (1951) 171—189, f. 1—20.
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- ,
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 2. List of Malaysian Pteridophytes
 3. The morphology of ferns
 4. and 5. General keys to Pteropsida
 6. Keys to the genera of Pteropsida
 7. Bibliography
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- , Gleicheniaceae — Flora Malesiana II, 1 (1959) 1—36, f. 1—16.
- , Schizaceae — Flora Malesiana II, 1 (1959) 37—61, f. 1—15.
- , Vegetative characters distinguishing the various groups of ferns included in Dryopteris of Christensen's Index Filicum, and other ferns of similar habit and sori — Gard. Bull. Sing. 17 (1960) 361—367.
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PHANEROGAMAE

Phanerogamae diversae¹⁾

- C. A. BACKER, R. C. BAKHUIZEN VAN DEN BRINK Jr. & C. G. G. J. VAN STEENIS, Identification of the new species and combinations proposed by C. P. Thunberg in the *Flora Javanica* by L. Winberg and F. O. Widmark (1825) — *Blumea* 6 (1950) 358—362.
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The above bibliography gives the published results of *Flora Malesiana* up to the present date, including some papers which were still in the press when this list was composed. Some medium to large families the publication in *Flora Malesiana* of which can be expected in a near future (say within some 5 years) include *Bombacaceae*, *Celastraceae*, *Cyperaceae*, *Epacridaceae*, *Ericaceae*, *Loganiaceae*, *Malvaceae*, *Moraceae*, *Myristicaceae*, *Sapotaceae*, and *Verbenaceae* in series I, and in series II *Cyatheaceae*, the *Lindsaya*-group, and *Lycopodiaceae*.

III. PRESENT STAFF (H. J. Lam & P. W. Leenhouts)

Up to Dec. 1957 the funds necessary to cover the considerable expenses of the Foundation were provided by the Government of the Indonesian Republic. When these were, for the time being, no longer available — temporarily it is hoped — the Netherlands (Government) Organization for Pure Scientific Research (Z. W. O.) generously consented to support

the project, so as to ensure its continuation, with the intention that the necessary means should gradually be drawn from the annual budget of the State University of Leiden. This means that soon the entire staff of Flora Malesiana will be incorporated in that of the Rijksherbarium, although the Foundation will continue to work as a separate body, in close co-operation with those permanent staff-members of that institute, who are forming its Tropical Plants Department. Additional generous support was granted by the British Commonwealth under the C. D. & W. Scheme.

The team of full-time workers for Flora Malesiana consists now of: Prof. Dr C. G. G. J. van Steenis, Dr Ding Hou, Dr P. W. Leenhouts, and Mr M. Jacobs, all still in service of the Foundation, Dr H. Sleumer and Mr J. H. Kern, already in service of the Rijksherbarium; moreover, Prof. Dr R. E. Holttum, England, and Mr J. Sinclair, Singapore, are almost full-time co-operators.

The Board of Trustees consists of: Ir Sadikin, Chairman, Prof. Dr H. J. Lam and Mr A. Dilmy, Vice-Presidents, and Prof. Dr C. Skottsberg, Mr E. J. H. Corner, and Mr Moh. Wadri as members.

CARIBBEAN BRACKISH AND FRESHWATER CYANOPHYCEAE

by

JOSEPHINE TH. KOSTER

(Rijksherbarium, Leiden)

Among the extensive collections of algae made by Dr P. Wagenaar Hummelinck (Utrecht) in the Antilles and adjacent regions during the years 1930, 1936, 1937, 1948—1949, 1955, a number of chiefly brackish, but also freshwater, Cyanophyceae were incorporated. This collection was kindly committed for study to the author. She is indebted to Dr F. Drouet, who identified part of it. Most of the localities have been amply described by the collector (1940, 1953), who also included pictures of several localities in the same papers.

The map illustrating this paper was drawn by the collector. He also was so kind as to complete the descriptions of the localities in the present paper.

LIST OF THE LOCALITIES AND ANALYSES OF THE SAMPLES

The data concerning the localities sampled in 1930—1949 are derived from Wagenaar Hummelinck (1940, 1953). The localities visited in 1955 will be described and figured in a forthcoming volume of the "Studies on the Fauna of Curaçao and other Caribbean Islands".

As Redeke's (p. 43) conception of brackish water is followed here, most of the localities concerned are considered brackish. For, that author draws the limit between fresh and brackish water at Cl 100 mg/l, and between brackish and seawater at Cl 17000 mg/l.

No mention has been made, as a rule, of the colour of the algae, since the material was received in formalin or alcohol. It is now preserved as exsiccatae in the Rijksherbarium at Leiden.

SOUTH AMERICAN MAINLAND

Colombia

- 114 LAGUNA DEL PÁJARO (La Goajira), very shallow pond, 300 × 200 × ? 1½ m, clayish mud; water clear, colourless, 26—32°C, HCO₃ 450 mg/l, total hardness 19 Germ.°, Cl 820 mg/l (brackish); 21 I 1937.

Gloeotrichia natans (Hedw.) Rabenh. ex Born. & Flah. — det. F. Drouet.

Together with *Oedogonium crispum* (Hass.) Wittr. var. *uruguayense* Magnus & Wille (Van den Hoek, p. 593), *Chara zeylanica* Willd. (Van den Hoek, p. 593), *Najas*.

Venezuela

553 RANCHO GRANDE (Aragua), Estación Biológico, small spring at Toma de Agua, 1200 m alt., among mosses; water clear, colourless Cl 110 mg/l (brackish); 18 III 1955.

Coccochloris stagnalis Spreng., numerous, cells (without sheath) 5 μ diam., 6 μ long — fig. 1.

Coccochloris peniocystis (Kütz.) Drouet & Daily, abundant, cells 2 μ diam., somewhat curved, with rounded ends — fig. 4.

Lyngbya allorgei Frémy, numerous, transverse walls often indistinct, filaments 3 μ diam., cells 5 μ long — fig. 49.

Oscillatoria okenii Ag. ex Gom., fairly numerous, trichomes 6 μ diam., cells 2 μ long — fig. 77.

Together with *Vaucheria* (fairly numerous), *Diatomeae* (fairly numerous).

S.N. MORRO DE ESMERARDA, West of Carúpano (Sucre), on moist schists in small cave near sea shore; 10 VI 1936.

Coccochloris elabens (Bréb.) Drouet & Daily (*Synechococcus elongatus* Naeg.), abundant, cells pale blue-green, cylindrical or oblong-elliptic, 2—3 μ diam., 5—10 μ , sometimes 13 μ , 16 μ and 30 μ long — fig. 3.

Entophysalis rivalaris (Kütz.) Drouet (*Gloeocapsa dermochroa* Naeg.), abundant, forming irregular cell-rows, sheaths diaphanous, indistinctly lamellate, sometimes thick and asymmetrical, cells blue-green, spherical, sometimes nearly hemispherical or ellipsoid-spherical, with sheaths 5—7 μ diam., without sheaths 3—4 μ , usually 2 μ , sometimes 4 μ diam. Agrees with the type of *Gloeocapsa dermochroa* Naeg. — fig. 14.

Suriname

406 SWAMP AT KRÉPI, near Charlesburg, N of Paramaribo, ? 40 \times 25 \times 1 m, in shell bearing sand, swamp vegetation; water clear, slightly bluish, HCO_3 30 mg/l, total hardness 3 Germ.°, Cl 18 mg/l (fresh); 2 VIII 1948.

Tolypothrix lanata (Ag.) Wartm. ex Born. & Flah., abundant, filaments fairly sparsely branched, 12—17 μ diam., trichomes 5—8 (usually 8) μ diam., cells pale blue-green, 6—16 (rarely 22) μ long, heterocysts 1—3 in a row, up to 28 μ long — fig. 22.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly rare, often calcified, filaments 16—18 μ diam., trichomes 13 μ diam., cells 2.5 μ long.

Lyngbya martensiana Menegh. ex Gom., abundant, filaments 8—13 μ diam., sheaths rough at the outside, trichomes more or less

rounded, rarely attenuate-obtuse at the end, 5—6.5 μ diam., cells 3—5 μ long. The trichomes of this species are usually broader (6—10 μ), but from Puerto Rico Gardner has described a variety with 4.8—5 μ thick trichomes — *fig. 56*. Together with Dinoflagellatae, Diatomeae, Hydrocotyle, Typha, Helicoma, Cyperus.

566 DECAYING PALM AT KABEL, near Suriname River, pool; water of about Cl 110 mg/l (brackish); 2 IX 1955.

Stigonema ocellatum (Dillw.) Thuret ex Born. & Flah., fairly numerous, filaments 27—32 μ diam., cells 16—18 μ diam.. Agrees well with Rabenhorst Alg. n. 2398. *Sirosiphon ocellatus* β *globosus* cited among the synonyms by Bornet & Flahault. These authors yet record thicker filaments for the species: filaments 35—45 μ diam., cells 20—30 μ diam. — *fig. 17*.

Hapalosiphon pumilus (Kütz.) Kirchner ex Born. et Flah., numerous. This material, as well as *Hapalosiphon* from Suriname 642 and 646, agrees with the description of *Hapalosiphon brasiliensis* Borge, which according to Drouet (1938, p. 638) is a synonym of *H. pumilus* (Kütz.) Kirchner ex Born. & Flah..

Scytonema coactile Mont. in Kütz. ex Born. & Flah., numerous, filaments 18—23 μ diam., trichomes 6—9 μ diam., cells usually longer than their diameters, in younger parts as long as or shorter. Bornet & Flahault record for the diameter of the filaments 18—24 μ , for that of the trichomes 12—18 μ . However, in the duplicate of the type in Herb. Kützing from the Antilles ("in mari") the diameter of the filaments is 10—13 μ , that of the trichomes 7 μ . In *Scytonema coactile* var. *minor* Wille (in Hedwigia 53, 1913, p. 145) from Samoa Islands, the diameter of the filaments is 14 μ , that of the trichomes 10 μ . Thus the diameter of the filaments of *Scytonema coactile* seems to vary from 10 to 23 μ , that of the trichomes from 6—18 μ . *Scytonema fritschii* Ghose probably is a synonym of *S. coactile* — *fig. 21*.

Together with Oedogonium (numerous), Bulbochaete (fairly numerous), Spirogyra (numerous).

642 SWAMP OF BERSEBA, at Curupina Creek, Republiek, swamp vegetation on soft mud; water clear, Cl 109 mg/l (brackish); 3 IX 1955.

Hapalosiphon pumilus (Kütz.) Kirchner ex Born. & Flah., numerous, filaments of main axis 9—14 μ diam., of branches 5—6 μ diam., cells of main axis disc- or barrel-shaped or more or less spherical or cylindrical with rounded corners, 8—13 μ diam., 4.5—23 μ long, of the branches cylindrical, 4.5 μ diam., 11—32 μ long, sometimes 7 times as long as the diameter — *fig. 18*.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, sheaths yellowish brown, filaments 11 μ diam., cells 10 μ diam., 5 μ long.

646 DITCH AT KABEL, near Suriname River, swampy pool along railway with plant decay; water clear, Cl 107 mg/l (brackish); 2 IX 1955.

Hapalosiphon pumilus (Kütz.) Kireh. ex Born. & Flah., abundant, filaments of main axis 9—11 μ diam., of the branches 6—8 μ diam., cells cylindrical with rounded corners, 8 μ diam., 6—14 μ long, of the branches cylindrical, 3—4.5 μ , sometimes at the end up to 7 μ diam., 9—27 μ long, heterocysts 4—6 μ diam., 9—12 μ long — *fig. 19*.

Tolypothrix lanata (Desvaux) Wartm. ex Born. & Flah., not numerous, filaments 13—18 μ diam., trichomes 9—11 μ diam. — *fig. 23*.

Together with *Oedogonium*, *Bulbochaete*, *Scenedesmus*, *Pediastrum*, *Desmidiaceae*.

LESSER ANTILLES

A r u b a

- 93b) FONTEIN, artificial pond at spring from cavern water, 20 \times 15 \times 1/2 m, mud, limestone rock and plant decay, with floating algae masses; water clear, colourless, HCO_3 150 mg/l, total hardness 17 Germ. $^\circ$, Cl 460 mg/l (brackish); 30 XII 1948.

Anacystis montana (Lightf.) Drouet & Daily (*Microcystis marginata* (Menegh.) Kütz.), fairly numerous, colony spherical, cells crowded, 3 μ diam.

Anacystis dimidiata (Kütz.) Drouet & Daily (*Chroococcus turgidus* (Kütz.) Naeg.), fairly numerous, cells 18 μ diam.

Agmenellum quadruplicatum (Menegh.) Bréb., numerous, cells 4 μ diam., 4.5 μ long.

Gomphosphaeria aponina Kütz., fairly numerous, cells 6 μ diam., 9.5 μ long.

Oscillatoria limosa Ag. ex Gom., abundant, trichomes blue-green, 18 μ diam..

Spirulina subtilissima Kütz. ex Gom., numerous, windings 2.5 μ wide, not touching each other though very near, filaments 1 μ diam.. Together with *Rhizoclonium riparium* (Roth) Harvey (= *Rh. hieroglyphicum* (Ag.) Kütz., Van den Hoek, p. 593).

- 102A) POS DI NOORD, slowly flowing small pool at spring among diorite debris, sand and mud; water clear, almost colourless, 27—30°C, pH 8.6—8.8, HCO_3 950 mg/l, total hardness 60 Germ. $^\circ$, Cl 3300 mg/l (brackish); 30 XII 1936.

Anabaena sphaerica Born. & Flah., fairly numerous, trichomes 5 μ diam., cells barrel-shaped, final cell conical, arthrospores elliptic, one on each side of a heterocyst.

Anabaena variabilis Kütz. ex Born. & Flah., abundant, trichomes 4—4.5 μ diam., cells barrel-shaped, final cell conical, arthrospores many in a row, spherical, 6 μ diam., heterocysts subspherical, 5 μ diam. — *fig. 29*.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant, filaments 14 μ diam., sheaths fairly thick, trichomes with rounded tips, cells very short.

Spirulina subsalsa Oersted ex Gom., fairly numerous, windings touching each other, 5 μ wide, filaments 2 μ diam..

Spirulina subtilissima Kütz. ex Gom., numerous, windings 4 μ wide, 2 μ distant, filaments 1 μ diam..

Together with numerous Diatomeae.

- 104 BRON DI ROOI PRINS, some slowly flowing water among rock debris near spring; water clear, colourless, about 29°C., pH 7,5—7,7, HCO₃ 600 mg/l, total hardness 36 Germ.°, Cl 1300 mg Cl/l (brackish); 9 I 1937.

Lyngbya semiplena (Ag.) J. Ag. ex Gom., numerous, filaments 9 μ diam..

Oscillatoria sancta Kütz. ex Gom., numerous, trichomes 10—11 μ diam., final cells sometimes with thickened wall — *fig. 66*.

- 104b Same locality, as before; water Cl 1780 mg Cl/l (brackish); 12 VIII 1955.

Lyngbya semiplena (Ag.) J. Ag. ex Gom., numerous, filaments 7—9 μ diam., cells $\frac{1}{5}$ — $\frac{1}{6}$ times as long as the diameter, final cell rounded — *fig. 50*. This species seems to have stuck to its habitat during 8 $\frac{1}{2}$ years.

Oscillatoria princeps Vauch. ex Gom., numerous, trichomes 32 μ diam., cells 4 μ long — *fig. 71*.

- 104A Same locality, some rapidly flowing water near spring, only several metres from sta. 104; water as in 104 (brackish); 9 I 1937 (Wagenaar Hummelinck, 1953, Pl. VIb).

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous, filaments 13 μ diam., trichomes 12 μ diam., final cell rounded.

Lyngbya lutea (Ag.) Gom., numerous, filaments 4 μ diam., trichomes nearly 4 μ diam., cells $\frac{1}{3}$ times as long as the diameter, final cell rounded — *fig. 47*.

Together with numerous Diatomeae.

- 104Ba Same locality, almost stagnant pool, 3 \times 2 \times $\frac{1}{2}$ m, only several metres from sta. 104, mud and sand, leaf decay, many algae; water 28—30°C, Cl about 1000 mg/l (brackish); 4 VII 1930.

Anacystis montana (Lightf.) Drouet & Daily, numerous, cells 3—4 μ diam..

Entophysalis conferta (Kütz.) Drouet & Daily, numerous, on filamentous algae, cells 4—5 μ diam., with sheaths 5—8 μ long.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous, filaments 13—15 μ diam., trichomes 10 μ diam., cells 2,5—3,5 μ long — *fig. 42*.

Lyngbya major Menegh. ex Gom., rare, filaments somewhat constricted at the cell-walls, 28—33 μ diam., sheaths rough outside, trichomes 16—17 μ diam., cells 2,5 μ long — *fig. 60*.

- 104Bb Same locality, same pool, 8 \times 2 \times $\frac{1}{2}$ m; water clear, colourless, Cl about 1350 mg/l (brackish); 26 VIII 1949.

Gomphosphaeria aponina Kütz., few.

Lyngbya semiplena (Ag.) J. Ag. ex Gom., numerous, filaments 9 μ diam..

Oscillatoria bonnemaisonii Crouan ex Gom., few, trichomes 18—32 μ diam. — *fig. 65*.

Together with fairly numerous Diatomeae.

- 104Bc Same locality, same pool, $3 \times 2 \times \frac{1}{2}$ m; water rather clear, almost colourless, Cl 1780 mg/l (brackish); 12 VIII 1955.

Coccochloris stagnina Spreng., fairly numerous.

Agmenellum quadruplicatum Bréb., fairly numerous.

Entophysalis conferta (Kütz.) Drouet & Daily, abundant, on *Lyngbya martensiana*.

Gomphosphaeria aponina Kütz., few.

Lyngbya martensiana Menegh. ex Gom., abundant, filaments 7—12 μ diam., trichomes 5—8 μ diam., final cell obtuse, cells $\frac{1}{4}$ as long as the diameter; hormogonia have been formed, one case of false branching was seen. Gomont (p. 97) has mentioned such occasional phenomena already in *Lyngbya* — *fig. 55*.

- 638 POOL AT EAGLE COLONY, West of Oranjestad, small, cemented pool in garden, $2 \times 1 \times \frac{1}{2}$ m, crowded with phanerogams; water clear, colourless, Cl 1720 mg/l (brackish); 22 VIII 1955.

Anabaena spec., sterile, few.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, filaments 20—23 μ diam., sheaths thick, yellowish brown inside, trichomes 12 μ diam. — *fig. 43*.

Together with Pithophora, *Rhizoclonium riparium* (Roth) Harvey.

- 641 TANKI ANDICURI, muddy pool, $50 \times 15 \times 1\frac{1}{2}$ m, deepest part in cocos garden, near sea shore; water turbid, Cl 3500 mg/l (brackish); 11 V 1955.

Anabaena spiroides Klebahn, fairly numerous, windings 25—28 μ wide, 18 μ distant, trichomes 7 μ diam., cells with pseudo-vacuoles, heterocysts spherical.

Anabaena spec., sterile, numerous.

Nodularia spumigena Mert. ex Born. & Flah., numerous, trichomes 9 μ diam., arthrospores 4—6 in a row — *fig. 31*.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant, filaments 11—14 μ diam., cells very short.

Together with Diatomeae.

C u r a ç a o

- 65A BAK DI HOFJE ARIBA, FUIK, cemented cistern, $4 \times 1 \times \frac{1}{4}$ m, filled from deep well, many algae; water clear, colourless, 28—36°C, pH 8.6—8.8, HCO_3 540 mg/l, total hardness 26 Germ.°, Cl 210 mg/l (brackish); 9 IX 1936.

Coccochloris stagnina Spreng. — det. F. Drouet.

Plectonema nostocorum Born. ex Gom. — det. F. Drouet.

Together with Cosmarium.

- 66 TANKI DI CAS KLEIN ST. JORIS, muddy pool, $12 \times 10 \times 1\frac{1}{2}$ m, plant decay; water rather clear, somewhat yellowish brown, 29—34°C, pH 8.5—9, HCO_3 450 mg/l, total hardness 95 Germ.°, Cl 1980 mg/l (brackish); 6 IX 1936.

Lyngbya diguetii Gom., on *Pithophora oedogonia* (Mont.) Wittr. and sterile *Oedogonium* — det. F. Drouet.

- 68 PUDDLE AT PISCADERA, short-living sheet of rain water on limestone terrace $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{10}$ m; water 29—36°C, pH 8,2—8,4, HCO_3 190 mg/l, total hardness 8 Germ.°, Cl 40 mg/l (fresh); 10 X 1936.

Nostoc sphaericum Vauch. ex Born. & Flah. — det. F. Drouet.

- 74 BRON CAJOEDA, HATO, rapidly flowing water piped from spring into small basin, $\frac{1}{2} \times \frac{1}{10}$ m; water clear, colourless, 29°C, pH 8,2—8,4, HCO_3 200 mg/l, total hardness 17 Germ.°, Cl 320 mg/l (brackish); 1 X 1936.

Coccochloris stagnina Spreng. — det. F. Drouet.

Schizothrix heufleri Grun. — det. F. Drouet.

Phormidium papyraceum (Ag.) ex Gom. — det. F. Drouet.

- 75 TANKI MAMAJA, HATO, muddy pond, $40 \times 20 \times 2$ m; water clear, nearly colourless, 27—31°C, pH 8,6—8,8, HCO_3 230 mg/l, total hardness 13 Germ.°, Cl 450 mg/l (brackish); 6 X 1936.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Hydrocoleum spec. — det. F. Drouet.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Together with *Spirogyra*, *Oocystis eremosphaeria* G. M. Smith, *Sphaerocystis schroeteri* Chodat, *Coelastrum cambricum* Archer, *Gloeotaenium loitlesbergianum* Hansg. (all Van den Hoek, p. 592), *Staurostrum*, *Najas*.

- 75a Same locality, same spot, pond $50 \times 25 \times 2$ m; HCO_3 225 mg/l, total hardness 12 Germ.°, Cl 380 mg/l (brackish); 11 X 1936.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet. Together with *Pithophora oedogonia* (Mont.) Wittr., *Chara zeylanica* Willd. (both Van den Hoek, p. 592).

- 76D BRON WANDONGO, HATO, cemented trough with water piped from spring, crowded with leaf decay; water 29 $\frac{1}{2}$ °C, Cl 250 mg/l (brackish); 27 VIII 1955 (Wagenaar Hummelinck, 1940, T. Vb).

Phormidium autumnale (Ag.) ex Gom. — det. F. Drouet.

Oscillatoria splendida Grev. ex Gom., fairly few — det. F. Drouet.

- 79 BRON SAN PEDRO, S., cemented gutter with rapidly flowing water from spring; water clear, colourless, 30°C, pH 7,6—8,2?, HCO_3 400 mg/l, total hardness 21 Germ.°, Cl 400 mg/l (brackish); 22 X 11936.

Lyngbya martensiana Menegh. ex Gom. — det. F. Drouet.

- 79B Same locality, cemented trough with water from spring, $5 \times 1 \times 1$ m, some plant decay, considerable growth of algae; water clear and colourless, HCO_3 335 mg/l, total hardness 15 Germ.°, Cl 390 mg/l (brackish); 13 II 1949.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Lyngbya martensiana Menegh. ex Gom. — det. F. Drouet.

Together with *Spirogyra submarina* (Coll.) Trans. (det. F. Drouet), abundant Diatomeae.

- 80Aa BRON SAN PEDRO, N., leaf decay of *Coccoloba uvifera*, moistened by percolating water from spring; water clear, HCO_3 360 mg/l, total hardness 22 Germ. $^\circ$, Cl 495 mg/l (brackish); 13 II 1949.

Rivularia haematites (DC.) Ag. ex Born. & Flah. — det. F. Drouet.

- 80Ab Same locality, small basin of sinter near spring, just getting dry, wet mud (brackish); 11 III 1949.

Microcoleus chthonoplastes (Fl. Dan.) Thuret ex Gom. — det. F. Drouet.

- 83 POS Ariba, DOKTERSTUIN, muddy pool, $15 \times 12 \times ?3$ m, leaf decay and many algae; water clear, dark-brownish-green, $28-33^\circ\text{C}$, pH 9.0–9.8 $^\circ$, HCO_3 680 mg/l, total hardness 41 Germ. $^\circ$, Cl 710 mg/l (brackish); 27 X 1936.

Lyngbya martensiana Menegh. ex Gom. — det. F. Drouet.

- 86 POS SORSAKA, Christoffel area, shallow, small pool near spring in diabase debris, water turbid, brownish-yellow, slightly polluted by cattle, about 28°C , HCO_3 500 mg/l, total hardness 49 Germ. $^\circ$, Cl 600 mg/l (brackish); 10 XI 1936.

Anacystis thermalis (Menegh.) Drouet & Daily — det. F. Drouet.

- 88a POS SJIMARRÓN, Bron di Rooi Beroe, Savonet, stagnant pool near spring, among siliceiferous cherts; water clear, yellowish brown, HCO_3 790 mg/l, Cl 1490 mg/l (brackish); 23 XII 1948.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

- 89 TANKI DI HOEJE SAVONET, artificial pool, $12 \times 10 \times 1\frac{1}{2}$ m, diabase detritus and brickwork, crowded with algae; water rather clear, somewhat greenish, slightly polluted, $28-34^\circ\text{C}$, HCO_3 780 mg/l, total hardness 160 Germ. $^\circ$, Cl 3200 mg/l (brackish); 29 X 1936.

Lyngbya lagerheimii (Moebius) Gom. ex Gom., numerous, filaments 2.6μ diam., sheaths very thin, cells as long as the diameter or slightly longer — also det. F. Drouet — fig. 40.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Lyngbya aerugineo-coerulea (Kütz.) ex Gom., fairly numerous, filaments 5μ diam., trichomes 4μ diam., cells pale blue, slightly shorter than the diameter to half as long as the diameter, final cell rounded — fig. 52.

The type of *Lyngbya aerugineo-coerulea* (Kütz.) ex Gom. is *Oscillaria aerugineo-coerulea* Kütz. (1843, p. 185). Gomont has studied a "*specimen authenticum*" in herb. Lenormand. Kützing mentions the trichomes to have a diameter of $\frac{1}{720}$ *linea parisiensis*, which is about 3.4μ . The trichomes of the type (in Infusionen, Nordhausen), preserved in the Rijksherbarium, Leiden, appear to have a diameter of 4μ , the filaments of 5μ , the cells are $1.5-3 \mu$ long. According to Kützing the cells are nearly as long as the dia-

meter: *articulis homogeneis, diametro subaequalibus*.¹ Gomont gives 4–6 μ for the diameter of the trichomes, and nearly as long as or half as long as the diameter for the length of the cell. From Kützing's drawings (1845–1849, T. 39 fig. IX) the cells seem to have a length of $\frac{1}{2}$ – $\frac{2}{3} \times$ the diameter which agrees with the measurements of the type. Kützing recorded the trichomes of *Oscillaria aerugineo-coerulea* to have an acuminate tip: *apiculo acuminato*. When studying the type one finds several trichomes escaped from the sheaths, having attenuate obtuse tips, but those which remained in the sheaths have rounded tips — *fig. 51*.

Oscillatoria limosa Ag. ex Gom., fairly numerous, trichomes 13–20 μ diam., 2.5 μ long.

Oscillatoria princeps Vauch. ex Gom. — det. F. Drouet.

Spirulina subtilissima Kütz. ex Gom., numerous, windings 2 μ wide, 1 μ distant, filaments 0.6 μ diam., cells pale blue.

Spirulina major Kütz. ex Gom., numerous, windings 4 μ wide, 2–3 μ distant, filaments 2 μ diam., cells pale blue — *fig. 78*.

Together with *Oedogonium howardii* West, *Spirogyra fluviatilis* Hilse, *Chara zeylanica* Willd. (all Van den Hoek, p. 592).

- 389 POOL AT CAS CORÁ, Agr. Exp. Station, concrete basin, 5 \times 1 $\frac{1}{2}$ \times 1 m, some plant decay, growth of Nymphaea; water clear, colourless, HCO₃ 480 mg/l, total hardness 340 Germ.°, Cl 690 mg/l (brackish); 11 XII 1948.

Agmenellum quadruplicatum (Menegh.) Bréb., rare, cells 2.5 \times 3 μ .

Schizothrix calcicola (Ag.) ex Gom., abundant, filaments more or less twisting, no branching found, filaments 3–40 μ diam., sheaths lamellate, containing 1–2 (usually 1), sometimes 3 or 4 trichomes, trichomes 1.5–2 μ diam., cells 5–9 μ long, final cell subacute or obtuse — *fig. 36*.

- 391 POOLS NEAR JULIANADORP, from Chinese gardens, concrete basins, 2 \times 1 \times $\frac{1}{2}$ m, some detritus; water rather clear, colourless, Cl estimated 600–1000 mg/l (brackish); leg. J. G. de Jong, 4 I 1950.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Rivularia haematites (DC.) Ag. ex Born. & Flah. — det. F. Drouet.

Calothrix parietina (Naeg.) Thuret ex Born. & Flah. — det. F. Drouet.

Together with *Pithophora aequalis* Wittr., *Pithophora polymorpha* Wittr., *Rhizoclonium riparium* (Roth) Harvey (= *Rh. hieroglyphicum* (Ag.) Kütz.), all Van den Hoek, p. 592.

- 396c TANKI DI TERRA CORÁ, muddy pool, 3 \times 2 $\frac{1}{2}$ \times $\frac{1}{10}$ m; water turbid, greyish, 29–33°C, HCO₃ 240 mg/l, total hardness 15 Germ.°, Cl 480 mg/l (brackish); 11 II 1949.

¹ *dimidiatus*, the following word, may indicate that the cells were measured after division, for, on p. 186 n. 15 of the same book we find: *articulis diametro duplo brevioribus, dimidiatis*, which seems to prove that *dimidiatus* cannot be meant to indicate here half as long as.

Oscillatoria princeps Vauch. ex Gom. — det. F. Drouet.

Together with *Ruppia*, *Spirogyra*, *Chara* (dry in March—August).

- 397a TANKI MARTHA KOOSJE, near Kleine Berg, muddy pool, $35 \times 25 \times ? 1\frac{1}{2}$ m, much algae; water slightly turbid, greyish, $27-29^{\circ}\text{C}$, pH $? 9$, HCO_3 305 mg/l, total hardness 8 Germ. $^{\circ}$, Cl 125 mg/l (brackish); 1 XII 1948.

Coccochloris stagnina Spreng. — det. F. Drouet.

Together with *Sphaerocystis Schroeteri* Chodat, *Oedogonium capitellatum* Witttr., *Oed. howardii* G. S. West, *Zygnemopsis americana* Transeau, *Spirogyra nitida* (Dillw.) Link (all Van den Hoek, p. 592), *Najas*.

- 397c Same locality; water $28-29^{\circ}\text{C}$, pH 9, HCO_3 120 mg/l, total hardness 16 Germ. $^{\circ}$, Cl 280 mg/l (brackish); 11 II 1949.

Gloeotrichia pisum (Ag.) Thuret ex Born. & Flah. — det. F. Drouet.

Together with *Oedogonium infinium* Tiffany, *Oed. howardii* G. S. West, *Spirogyra pseudospreiana* Jao, *Sp. fuellebornii* Schmidle (all det. Van den Hoek), *Chara*, *Najas*, *Echinodorus*.

- 398 TANKI NOBO DI MALPAYS, muddy pool, dug a few months ago, $50 \times 10 \times ? 1\frac{1}{2}$ m; water turbid, greyish brown, HCO_3 275 mg/l, total hardness 10 Germ. $^{\circ}$, Cl 120 mg/l (brackish); 28 X 1948.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Lyngbya versicolor (Wartm.) ex Gom. — det. F. Drouet.

- 399 POS CAJOEDA, Knip, puddle in dry river bed, $2 \times 1\frac{1}{2} \times \frac{1}{5}$ m, mud, rock debris of siliceiferous shales, much leaf decay; water rather clear, greenish, 33°C , HCO_3 240 mg/l, total hardness 23 Germ. $^{\circ}$, Cl 390 mg/l (brackish); 17 VIII 1948.

Amphithrix janthina (Mont.) ex Born. & Flah., numerous — det. F. Drouet.

Oscillatoria limosa Ag. ex Gom., abundant, trichomes $13-16 \mu$ diam., cells brown, $\frac{1}{4}-\frac{1}{6} \times$ as long as the diameter, final cell rounded, with thickened wall — fig. 68.

Together with *Stigeoclonium*.

Klein Curaçao

- 64 POS (well), N of lighthouse, basin in limestone, $1 \times 1 \times \frac{1}{2}$ m; water rather clear, somewhat brownish-green, $28-33^{\circ}\text{C}$, pH 7.9—8.2, HCO_3 430 mg/l, total hardness 19 Germ. $^{\circ}$, Cl 530 mg/l (brackish); 29 VIII 1936.

Gomphosphaeria aponina Kütz. — det. F. Drouet.

Lyngbya versicolor (Wartm.) ex Gom. — det. F. Drouet.

- 387 POS (well), N of lighthouse, basin in limestone, $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ m, considerable growth of algae; water clear, colourless, HCO_3 305 mg/l, total hardness 17 Germ. $^{\circ}$, Cl 725 mg/l (brackish); 1 X 1948.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Lyngbya versicolor (Wartm.) ex Gom. — det. F. Drouet.

Bonaire

- 44 POS BRONSWINKEL, overflowing well, $8 \times 8 \times 2$ m, in porphyrite, rock debris, mud, and leaf decay, crowded with algae; water clear, nearly colourless, $28-30^{\circ}\text{C}$, pH 7.5—8, HCO_3 420 mg/l, total hardness 14 Germ. $^{\circ}$, Cl 530 mg/l (brackish); 27 III 1937.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous.

Lyngbya martensiana Menegh. ex Gom. var. *minor* Gardner, numerous, trichomes 5μ diam., cells $1\frac{1}{3}-1\frac{1}{8} \times$ as long as the diameter.

Together with *Microspora stagnorum* (Kütz.) Lagerh. (Van den Hoek, p. 591).

- 44b Same locality, as before, crowded with algae and phanerogams; Cl 560 mg/l (brackish); 23 VIII 1955.

Lyngbya aerugineo-coerulea (Kütz.) ex Gom., fairly numerous, filaments 5μ diam., trichomes 4μ diam., cells 1.5—2 μ long, final cell rounded, somewhat thickened — fig. 53.

Oscillatoria limnetica Lemm., fairly numerous, trichomes 2μ thick, slightly constricted at the cell-walls, cells 5—6 μ long, final cell obtuse — fig. 75.

- 44Aa BRON DI POS BRONSWINKEL, a little water seeping from below pieces of rock and flowing to the Pos (well), muddy sand with sheets of algae; water clear, colourless, Cl about 550 mg/l (brackish); 23 VIII 1955.

Microcoleus cavanillesii Guerrero, numerous, sheaths indistinct, fairly thick, outside rough, trichomes 2—15 in a sheath, parallel or spirally twisted, 3μ diam., cells $1\frac{1}{2} \times$ as long as the diameter, transverse walls indistinct, final cell long and tapering, very acute — fig. 35. This species is very near *Microcoleus acutissimus* Gardner emend. Drouet, as Guerrero noticed already. In the type the sheaths contain 1—8 trichomes; in Hummelinck's material from sta. 44Aa 2—15, and in *M. acutissimus* up to 30. In the type the trichomes are 2.5—3 μ diam., the cells circa $2 \times$ as long as the diameter, in Wagenaar Hummelinck 44Aa the trichomes are 3μ diam., the cells $1\frac{1}{2} \times$ as long as the diameter, and in *M. acutissimus* the trichomes are 1.7—2.3 μ diam., the cells are $2-3\frac{1}{2} \times$ as long as the diameter. The type was found growing in a river, Wagenaar Hummelinck 44Aa was collected in a very small spring, and *M. acutissimus* on walls, rocks, etc..

- 45 Dos Pos, rather deep artificial well, $4 \times 3 \times 2.5$ m, in non-calcareous rock, frequently stirred; water clear, colourless, $27-30^{\circ}\text{C}$, pH 7.5—7.7, HCO_3 520, total hardness 20 Germ. $^{\circ}$, Cl 450 mg/l (brackish); 27 III 1937.

Anabaena variabilis Kütz. ex Born. & Flah., fairly numerous, cells 4μ diam., arthrospores young — fig. 30.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous.

- 48 BRON FONTEIN, some flowing water in cemented gutter near spring on cavern water, among some leaf decay in the shade; water

clear, colourless, about 28°C, pH about 8.3, HCO_3 350 mg/l, total hardness 22 Germ.°, Cl 350 mg/l (brackish); 13 XI 1936.

Anacystis montana (Lightf.) Drouet & Daily, abundant, cells with sheath 5–8 μ diam., without sheath 2–4 μ diam. — *fig. 5*.

Anacystis dimidiata (Kütz.) Drouet & Daily, fairly numerous, cells with sheath 16 μ diam., without sheath 10 μ diam. — *fig. 6*.

Johannesbaptistia pellucida (Dickie) W. R. Taylor & Drouet, rare, sheaths indistinct, cells 3–4 μ diam., $1/2 \times$ as long as the diameter — *fig. 9*.

Entophysalis rivularis (Kütz.) Drouet & Daily, fairly numerous, cells usually 2 in a sheath, sometimes single, sometimes 4, globular, with sheath 5 μ diam., without sheath 2–3 μ diam. — *fig. 15*.

Calothrix braunii Born. & Flah., fairly numerous, filaments 16 μ diam. at the base, sheaths golden brown inside, hyaline outside, lamellate especially at the base, trichomes 10 μ diam. at the base, transverse cell-walls indistinct, cells as long as the diameter or somewhat longer or shorter, heterocysts basal, hemispherical, 10–12 μ diam. — *fig. 27*.

Schizothrix lardacea (Ces.) ex Gom., abundant, filaments without branches, containing only one trichome, twisted, intertwined, tapering towards the top, 3–4 μ diam., trichomes usually 2 μ , sometimes 1.5 μ diam., cells $2\text{--}3\frac{1}{2} \times$ as long as the diameter, final cell slightly attenuate, obtuse — *fig. 37*.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, filaments 10–13 μ diam., sheaths lamellate, trichomes 6–10 μ diam., cells 3.5 μ long.

- 52 Pos ICHI, S of Kralendijk, muddy hole in limestone, $3 \times 1 \times 1\frac{1}{2}$ m; water turbid, brownish-yellow, 28–34°C, pH 7.9–8.1, HCO_3 190 mg/l, total hardness 10 Germ.°, Cl 160 mg/l (brackish); 14 XI 1936.

Nostoc sphaericum Vauch. ex Born. & Flah., trichomes sometimes short, 4 μ diam., cells globular — *fig. 33*.

- 52d Same locality; HCO_3 395 mg/l, total hardness 16 Germ.°, Cl 90 mg/l (fresh); leg. Frater Arnoldo, 27 XII 1948.

Schizothrix vaginata (Naeg. in Kütz.) ex Gom., filaments fairly much branched, containing usually one to many trichomes in a broad sheath, sometimes one trichome in a narrow sheath, trichomes 3 μ diam., cells $1\text{--}1\frac{1}{2} \times$ as long as the diameter, final cell obtuse — *fig. 38*.

- 52e Same locality; $2 \times 1 \times \frac{1}{3}$ m; water turbid, greyish brown, slightly polluted, pH about 8.7, HCO_3 240 mg/l, total hardness 12 Germ.°, Cl 90 mg/l (fresh); 21 II 1949.

Lyngbya kuetzingii Schmidle, abundant, filaments rigid, short, 18–27 μ long, 3 μ diam., cells very short — *fig. 39*.

- 53c Pos BACA, S of Kralendijk, rather artificial hole in limestone, $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ m, rock and black mud, many algae; water clear, slightly greenish, HCO_3 165 mg/l, total hardness 54 Germ.°, Cl 2580 mg/l (brackish); 16 IX 1948.

Gomphosphaeria aponina Kütz., fairly few.

Entophysalis conferta (Kütz.) Drouet & Daily, numerous, epiphytic on *Rhizoclonium riparium* and *Lyngbya aestuarii*, sparsely or densely growing, cells 4—5 μ diam., 6—18 μ long, exospores 1—4 — fig. 11.

Lyngbya kuetzingii Schmidle, numerous, attached to *Spirogyra*, filaments 2.5 μ diam., 10—60 μ long, sheaths narrow, cells 1 μ diam..

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, filaments 10—33 μ diam., sheaths yellowish brown, thick, lamellate, rough outside, trichomes 8—12 μ diam., cells 2—3 μ long, final cell with somewhat thickened wall, hormogones formed — fig. 44.

Oscillatoria princeps Vauch. ex Gom., numerous, trichomes 27—44 μ diam., often curved at the top, cells 4—8 diam., $\frac{1}{4}$ — $\frac{1}{8}$ \times as long as the diameter — fig. 72.

Together with *Rhizoclonium implexum* (Dillw.) Kütz. (= *Rh. hieroglyphicum* (Van den Hoek, p. 591).

- 54b POS BACA CHIKTOE, muddy puddle in sink hole near Pos Baca, $\frac{3}{4} \times \frac{1}{2} \times \frac{1}{2}$ m; water turbid, greyish, HCO_3 395 mg/l, total hardness 17 Germ. $^\circ$, Cl 230 mg/l (brackish); leg. Frater Arnoldo, 27 XII 1948.

Lyngbya martensiana Menegh. ex Gom., numerous filaments 8—10 μ diam., sheaths rough outside, trichomes 5—7 μ diam., cells slightly shorter than the diameter — fig. 57.

- 57c POS CARANJA, natural hole in limestone with cavern water, $4\frac{1}{2} \times 2 \times 1$ (—3) m, tidal movements, rock and soft black mud; water clear, colourless, HCO_3 180 mg/l, total hardness 21 Germ. $^\circ$, Cl 620 mg/l (brackish); 5 IX 1948.

Entophysalis rivularis (Kütz.) Drouet & Daily, numerous, cells 3—4 μ diam..

Lyngbya aerugineo-coerulea (Kütz.) ex Gom., numerous, filaments 6 μ diam., trichomes 4 μ diam., transverse walls often indistinct, cells about as long as diameter.

- 57d Same locality, pH 7.4, Cl 3330 mg/l (brackish); 21 II 1949.
Microcoleus chthonoplastes (Fl. Dan.) Thur. ex Gom., fairly numerous.

- 58b POS FRANCÉS, E of Punt Vierkant, waterhole in limestone, $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$ m mud; water slightly turbid, Cl 740 mg/l (brackish), 1 IV 1955.

Nostoc spec., very young, rare.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly few, trichomes 8—9 μ diam..

Lyngbya diguetii Gom., numerous, filaments 3 μ diam., sheaths very narrow, cells about as long as the diameter.

Lyngbya aerugineo-coerulea (Kütz.) ex Gom., fairly few, filaments 4.5 μ diam., cells about as long as the diameter.

Oscillatoria okenii Ag. ex Gom., numerous, trichomes 4.5—6 μ diam. (according to Gomont 16, p. 232: 5.5—9 μ , according to Geitler (1932, p. 969) in var. *gracilis* Kütz.: 4—5 μ diam.).

Together with few Diatomeae.

- 58e Same locality, water rather clear, slightly greenish, Cl 1100 mg/l (brackish); 18 VIII 1955.
Lyngbya diguetii Gom., numerous, also growing among *Phormidium tenue* — fig. 48.
Lyngbya martensiana Menegh. ex Gom., numerous, trichomes 5—6 μ diam. (according to Gomont 16, p. 145: 6—10 μ diam.), cells $\frac{1}{4}$ — $\frac{1}{3}$ \times as long as the diameter — fig. 59.
Phormidium tenue (Menegh.) ex Gom., numerous, filaments, 4 μ diam., trichomes 2—3 μ diam., somewhat constricted at the transverse walls, cells somewhat shorter than the diameter to twice as long as the diameter — fig. 62.
- 60b POS LANSBERG, S, waterhole in limestone, $1 \times \frac{3}{4} \times \frac{1}{10}$ m, soft mud, many algae; water rather clear, colourless, slightly polluted, Cl 8860 mg/l (brackish); 21 IX 1948.
Coccochloris stagnina Spreng., cells 4 μ diam..
Microcoleus chthonoplastes (Fl. Dan.) Thuret ex Gom., abundant, trichomes 4.5 μ diam..
Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous, trichomes 9 μ diam..
- 378 KRALENDIJK, sheet of water, $3 \times 2 \times \frac{1}{5}$ m, drying, mud and rock; water turbid, slightly greenish, 31°C, pH about 9, HCO_3 480 mg/l, total hardness 6 Germ.°, Cl 195 mg/l (brackish); 24 II 1949.
Nostoc sphaericum Vauch. ex Born. & Flah., trichomes short, curved straight, fairly crowded, 5 μ diam., heterocysts 6 μ diam. — fig. 34.
- 379a POS BACA GRANDI, S of Kralendijk, shallow sinkhole in limestone, $8 \times 7 \times \frac{1}{10}$, clayish mud; water clear, slightly greyish, HCO_3 mg/l, total hardness 34 Germ.°, Cl 1260 mg/l (brackish); 16 IX 1948.
Coccochloris stagnina Spreng., abundant, cells numerous, densely crowded, sheaths often indistinct, cells 3—3.5 μ diam., 4.5—6 μ long — fig. 2.
Agmenellum quadruplicatum Bréb., few.
Anacystis thermalis (Menegh.) Drouet & Daily, numerous.
Lyngbya lagerheimii Gom., abundant.
Lyngbya aerugineo-coerulea (Kütz.) ex Gom., few, filaments 6 μ diam., cells 3 μ long.
Oscillatoria obtusa Gardn., few.
Spirulina subtilissima Kütz. ex Gom., abundant.
Together with much *Chara zeylanica* Willd. (Van den Hoek, p. 391), much *Eleocharis*, some *Ruppia*.
- 379b Same locality; water clear, HCO_3 180 mg/l, total hardness 15 Germ.°, Cl 240 mg/l (brackish); leg. M. Arnoldo Broeders, 27 XII 1948.
Coccochloris stagnina Spreng., abundant, cells crowded, sheaths thick, cells 3—3.5 μ diam., 5—6 μ long.
Agmenellum quadruplicatum Bréb., numerous, cells 3 μ diam., 4.5 μ long.

Anacystis dimidiata (Kütz.) Drouet & Daily, numerous, cells without sheaths $22.5\ \mu$ diam., $31\text{--}36\ \mu$ long — fig. 7.

Lyngbya lagerheimii Gom., abundant, filaments usually irregularly here and there sparsely twisted, trichomes $2\ \mu$ diam., cells $2\times$ as long as the diameter; according to Gomont 16, p. 147—148: cells $1.2\text{--}3\ \mu$ long.

Oscillatoria obtusa Gardn., numerous, trichomes remarkably long, $25\ \mu$ diam., cells $4.5\ \mu$ long. This species has much similarity with *O. limosa*, but its trichomes are extremely long and $3\ \mu$ thicker — fig. 70.

Spirulina subtilissima Kütz. ex Gom., few, windings not touching each other, $1\ \mu$ distant, $2\ \mu$ wide, filaments circa $1\ \mu$ diam.. Together with much *Chara zeylanica* Willd. f. *trichacantha* (A. Braun) H. & J. Groves (Van den Hoek, p. 591), much *Eleocharis*, some *Ruppia*.

379c Same locality, almost dry; water clear, HCO_3 150 mg/l, total hardness 37 Germ. $^\circ$, Cl 1820 mg/l (brackish); 21 II 1949.

Coccochloris stagnina Spreng., abundant, cells $3\ \mu$ diam., $6\ \mu$ long.

Lyngbya lagerheimii Gom., numerous also in sheaths of colonies of *Coccochloris stagnina*, irregularly undulate or twisted, filaments $2\ \mu$ diam., cells longer than the diameter — fig. 41.

Spirulina subtilissima Kütz. ex Gom., fairly numerous, windings not touching each other, $2\ \mu$ wide, $0.7\ \mu$ diam..

Together with dense growth of *Eleocharis geniculata* (L.) R. & S. (*E. capitata* R. Br.).

Though the salinity of the water of this locality changed from Cl 1260 mg/l to Cl 240 mg/l in two months the algal vegetation did not alter much. Two months later, when the salinity was mounted up to Cl 1820 mg/l again, still three of the original eight species remained: *Coccochloris stagnina*, *Lyngbya lagerheimii*, *Spirulina subtilissima*.

381 POOL NE OF PUNT VIERKANT, sheet of water on limestone, $15\times 15\times 175\text{ m}$, mud and rock; water clear, colourless, HCO_3 240 mg/l, total hardness 14 Germ. $^\circ$, Cl 210 mg/l (brackish); 5 IX 1948.

Anacystis montana (Lightf.) Drouet & Daily, few.

Aulosira laxa Kirchn. ex Born. & Flah., abundant, filaments $6.5\ \mu$ diam., trichomes $4.5\ \mu$ diam., cells $2\text{ to }3\times$ as long as the diameter, arthrospores lacking — det. F. Drouet — fig. 24.

Nostoc sphaericum Vauch. ex Born. & Flah., fairly numerous, trichomes $14\ \mu$ diam.

Microcoleus chthonoplastes (Fl. Dan.) Thuret ex Gom., few, trichomes 10 to numerous in a sheath, sheaths $32\ \mu$ diam., trichomes $4\ \mu$ diam., cells twice as long as the diameter, cells $2\times$ as long as the diameter.

Lyngbya martensiana Menegh. ex Gom., fairly numerous, filaments $12\ \mu$ diam., trichomes $7\ \mu$ diam., cells $2\ \mu$ long.

- 384 POS FLAMBAAI, near Zuidpunt narrow hole in limestone, $\frac{2}{3} \times \frac{2}{3} \times \frac{3}{5}$ m, rock debris with thin coating of algae; water clear, almost colourless, Cl estimated at 1000—1200 mg/l (brackish); 31 IX 1948.
Lyngbya martensiana Menegh. ex Gom., numerous, filaments 9μ diam., trichomes 8μ diam., cells 3.5μ long.
Oscillatoria brevis Kütz. ex Gom., fairly numerous, trichomes $5-6 \mu$ diam..
- 628 TANKI DI SABANA KRALENDIJK, E of Pos Ichi, drying sheet of water on low limestone plateau, about $30 \times 80 \times \frac{2}{5}$ m, among *Conocarpus*; water rather clear, Cl 11200 mg/l (brackish); 16 IV 1955.
Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous.
 Together with *Chara hornemannii* Wallmann (Van den Hoek, p. 591), *Ruppia*, *Eleocharis*.
- 628A Same locality, pool of water, about $20 \times 30 \times \frac{1}{3}$ m; dry a few weeks ago, mud, floating sheets of algae; Cl 11900 mg/l (brackish); 22 VIII 1955.
Anacystis dimidiata (Kütz.) Drouet & Daily, few.
Johannesbaptistia pellucida W. R. Taylor & Drouet, fairly numerous, filaments 7μ diam., cells 5μ diam. — fig. 10.
Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, trichomes $10-14 \mu$ diam., cells 2μ long.
Lyngbya aerugineo-coerulea (Kütz.) ex Gom., fairly numerous, filaments 5μ diam., trichomes 4.5μ diam., cells half as long as the diameter.
Phormidium luridum (Kütz.) ex Gom., abundant, trichomes $1.5-2 \mu$ diam., cells 4.5μ long — fig. 64.
Oscillatoria sancta Kütz. ex Gom., numerous, trichomes constricted at the transverse walls, $9.5-14 \mu$ diam., cells 3μ long — fig. 67.
 Together with fairly numerous *Diatomeae*, much *Chara* and *Ruppia*.
- Klein Bonaire
- 61b POS DI CAS, cavern water, $6 \times 2 \times 1(-2?)$ m, in sink hole with soft black mud, polluted by goat faeces; water clear, almost colourless, HCO_3 480 mg/l, total hardness 37 Germ.°, Cl 620 mg/l (brackish); 7 IX 1948.
Entophysalis conferta (Kütz.) Drouet & Daily, numerous, epiphytic on *Rhizoclonium impleurum* and *Lyngbya aestuarii*, cells more or less globular, with sheaths $5-13 \mu$ diam., sheaths thin, endospores $2.5-4 \mu$ diam. — fig. 12.
Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant, filaments $12-18 \mu$ diam., trichomes $8-10 \mu$ diam., cells $1-3 \mu$ long, final cell slightly attenuate, rounded — fig. 45.
Lyngbya kützingeri Schmidle, fairly numerous, epiphytic on *Lyngbya aestuarii*, filaments 2μ diam., $16-130 \mu$ long, cells about as long as the diameter, transverse walls indistinct.
Oscillatoria princeps Vauch. ex Gom., abundant, trichomes $36-47 \mu$ diam. — fig. 73.

Together with *Rhizoclonium implexum* (Dillw.) Kütz. (= *Rh. hieroglyphicum* (Ag.) Kütz., Van den Hoek, p. 591), *Oedogonium*, *Diatomeae*.

- 63c TANKI CALBAS, pool in depression of limestone plateau, $12 \times 5 \times \frac{1}{4}$ m, after rains much larger, with some mud, incrustations; water clear, almost colourless, Cl 12160 mg/l (brackish); 7 IX 1948 (Wagenaar Hummelink, 1953, Pl. II b).

Anacystis montana (Lightf.) Drouet & Daily, abundant, cells 4.5μ diam..

Entophysalis deusta (Menegh.) Drouet & Daily, on rock, together with *Rivularia haematites*, cells without sheaths $4-6 \mu$ diam. — fig. 16.

Rivularia haematites (DC.) Ag. ex Born. & Flah., on rock, numerous, colonies hemispherical or confluent or extended to a layer, scantily incrustated with lime, zonate (on section), trichomes radiate, $4-5 \mu$ diam., with 2 or 3 basal heterocysts — fig. 26. Agrees with Wittrock & Nordstedt Alg. exsicc. n. 1310, except that in that material the trichomes have one basal heterocyst.

Together with *Chara zeylanica* var. *armata* (Meyen) Zanev. and var. *trichacantha* (A. Braun) H. & J. Groves (both Van den Hoek, p. 591), small *Ruppia*.

Bl an q u i l l a

- 35 POZO DE VALUCHU, well in coconut grove near shore, $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ m, debris and muddy sand; water slightly turbid, yellowish-grey, $28-30^\circ$ C, pH 7.5–7.8, HCO_3 500 mg/l, total hardness 47 Germ.°, Cl 1450 mg/l (brackish); 21 VII 1936.

Lyngbya semiplena (Ag.) J. Ag. ex Gom. — det. F. Drouet.

M a r g a r i t a

- 18 LAGUNA HONDA, SE of Juan Griego, shallow pond, $20 \times 30 \times ?1$ m, much larger in rain time, sandy mud, many algae; water slightly turbid, greenish, $26-32^\circ$ C, pH 6.9–7.1, HCO_3 160 mg/l, total hardness 5 Germ.°, Cl 150 mg/l (brackish); 16 V 1936.

Anacystis montana (Lightf.) Drouet & Daily, few.

Aulosira implexa Born. & Flah., numerous, filaments sometimes fasciate, $12-14 \mu$ diam., sheaths usually narrow, trichomes $9-9.5 \mu$ diam., cells 21μ long, younger parts moniliform, cells 6μ long, arthrospores lacking — fig. 25. Agrees with Wittrock & Nordstedt Alg. Exsicc. n. 787.

Together with *Chara zeylanica* Willd. (Van den Hoek, p. 591), few *Oedogonium*, *Najas*.

- 19 TOMA DE AGUA DE TACARIGUA, flowing water near source, piped into basin of brickwork; water 26° C, pH 6.4–6.7, HCO_3 395 mg/l, total hardness 4 Germ.°, Cl 80 mg/l (fresh); 11 VIII 1936.

Lyngbya putealis Mont. ex Gom., numerous, filaments 8μ diam., trichomes 7μ diam., constricted at the transverse walls, cells as long as the diameter or somewhat shorter — fig. 54.

- s.n. CANTARILLA DE SAN JUAN, cemented cistern in town, $7 \times 4 \times 1\frac{1}{2}$ m, scratched from wall; water pumped up from deep well, fairly clear, 28° C (midday), pH 7, fresh to the taste; 16 V 1936.

Anacystis montana (Lightf.) Drouet & Daily, numerous, cells 3—4 μ diam..

Dichothrix orsiniana (Kütz.) ex Born. & Flah., numerous, filaments 10—11.5 μ diam., sheaths yellowish brown, trichomes 7—8 μ diam., cells disc-shaped, 4.5 μ long — fig. 28.

Phormidium tenue (Menegh.) ex Gom., numerous, filaments 1.5—2 μ diam., slightly constricted at the transverse walls, cells slightly longer than diameter.

Los Testigos

- 31A POZA DEL PUERTO REAL, TAMARINDO, sheet of water near salina, $10 \times 10 \times \frac{1}{10}$ m, thick mud with coating of algae; water about 35° C; 15 VI 1936.

Phormidium tenue (Menegh.) ex Gom. — det. F. Drouet.

- 165 ISLA DE CONEJO, shallow cave in porphyrite, shady, almost no vegetation, among wet rock debris; 17 VI 1936.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Phormidium autumnale (Ag.) ex Gom., some — det. F. Drouet.

Tobago

- 656A LAMBEAU RIVER, near shore, muddy part of rivulet near mouth with many fiddler crabs; water turbid, brownish, 34° C, Cl 1600 mg/l (brackish); 15 I 1955.

Microcoleus chthonoplastes (Fl. Dan.) Thuret ex Gom. — det. F. Drouet.

Microcoleus tenerimus Gom. — det. F. Drouet.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Lyngbya confervoides Ag. ex Gom. — det. F. Drouet.

Lyngbya semiplena (Ag.) J. Ag. ex Gom. — det. F. Drouet.

Lyngbya putealis Mont. ex Gom. — det. F. Drouet.

Nevis

- 500 NELSON'S SPRING, fresh water lagoon, about $200 \times 15 \times 1\frac{1}{2}$ m, clay with swamp deposits, considerable growth of algae; water clear, colourless, pH 8.6, HCO_3 485 mg/l, total hardness 17 Germ.°, Cl 88 mg/l (fresh); 28 VI 1949 (Wagenaar Hummelinck, 1953, Pl. Ib).

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous, filaments 17—42 μ diam., sheaths more or less (in several places densely) incrusted with lime, trichomes 13 μ diam., cells 3—4 μ long. Gomont described several formae of this species, but he did not mention this incrusted form; Geitler (1932, p. 1052), however, reported that this species is often encrusted with lime — fig. 46.

Together with *Spirogyra distenta* Transeau, *Spirogyra punctiformis* Transeau (both Van den Hoek, p. 593), Najas.

- 501 JONES' RIVER, natural pools in rivulet, narrowly connected by flowing water, ($5 \times$) $1\frac{1}{2} \times \frac{1}{2}$ m, vulcanic rock debris and plant decay; water clear, colourless, pH 7.6, HCO_3 245 mg/l, total hardness 11 Germ. $^\circ$, Cl 230 mg/l (brackish); 28 VI 1949.

Scytonema coactile Mont. in Kütz. ex Born. & Flah., fairly few, filaments 18μ diam., trichomes 12μ diam., cells as long as the diameter, sometimes somewhat shorter or longer — *fig. 20*.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant, filaments $15\text{--}21 \mu$ diam., trichomes $13\text{--}16 \mu$ diam., cells very short, $2.5\text{--}3 \mu$ long.

Lyngbya putealis Mont. ex Gom., numerous, filaments 9μ diam., trichomes constricted at the transverse walls, cells as long as the diameter, or shorter or longer.

Lyngbya martensiana Menegh. ex Gom., numerous, filaments $12\text{--}14 \mu$ diam., sheaths outside rough, trichomes 8μ diam., cells 2μ long — *fig. 58*.

Together with Diatomeae.

- 502 HOT SPRING OF BATH, walled in spring of rivulet, $\frac{1}{2} \times \frac{1}{3}$ m, from weathered volcanic rock, rapidly flowing, sandy bottom with algae; water clear, colourless, about 42°C , pH 7.2, HCO_3 550 mg/l, total hardness 18 Germ. $^\circ$, Cl 70 mg/l (fresh); 28 VI 1949.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous, filaments 10μ diam., cells 2μ long.

Phormidium tenue (Menegh.) ex Gom., abundant, filaments 2.5μ diam., cells 6μ long — *fig. 63*.

Oscillatoria limosa Ag. ex Gom., fairly numerous, trichomes 17μ diam., cells 2μ long — *fig. 69*.

Oscillatoria okenii Ag. ex Gom., numerous, trichomes $6\text{--}7 \mu$ diam., slightly constricted at the transverse walls, cells 3μ long — *fig. 76*.

Antigua

- 665 WEIR'S POND, near Gunthorpes, muddy pool, $20 \times 10 \times \frac{1}{2}$ m; water rather turbid, brownish, 35°C , Cl 5830 mg/l (brackish); 14 VII 1955.

Phormidium valderianum Gom. — det. F. Drouet.
Together with abundant Chara, some Ruppia.

Barbuda

- 667 BULL HOLE, muddy pool in depression of limestone plateau, $20 \times 20 \times \frac{1}{3}$ m; water somewhat turbid, brownish, Cl 2200 mg/l (brackish); 9 VII 1955.

Coccochloris elabens (Bréb.) Drouet & Daily — det. F. Drouet.

Plectonema nostocorum Born. ex Gom., in the sheaths of *Coccochloris elabens* — det. F. Drouet.

Spirulina tenerrima Kütz. ex Gom., in the sheaths of *Coccochloris elabens* — det. F. Drouet.

Together with much Chara zeylanica Willd. (Van den Hoek, p. 593), much Najas, some Ruppia.

St. Eustatius

- 505 MANAHEGA CISTERN, DOWNTOWN, collapsed cemented cistern near shore, $6 \times 2\frac{1}{2} \times \frac{1}{3}$ m, muddy debris; water somewhat turbid, greenish yellow, pH abt. 8.5, HCO_3 1000 mg/l, total hardness 55 Germ.°, Cl 2300 mg/l (brackish); 7 VII 1949.

Oscillatoria amphibia Ag. ex Gom., forming surface film — det. F. Drouet.

Together with *Euglena*.

- 506 MANAHEGA WELL, NEAR CISTERN, recently constructed well, 2 m deep, $1 \times \frac{2}{3} \times \frac{1}{2}$ m, upper part cemented, rock debris and mud, some coating of algae; water almost clear, greenish yellow, pH 7.9, HCO_3 1090 mg/l, total hardness 95 Germ.°, Cl 1665 mg/l (brackish); 7 VII 1949 (Wagenaar Hummelinck, 1953, Pl. IV a).

Cocchochloris stagnina Spreng. — det. F. Drouet.

Lyngbya taylorii Drouet & Strickl., small form — det. F. Drouet.

- 511A KING'S WELL, DOWNTOWN, cemented through near deep well, $2 \times \frac{1}{2} \times \frac{1}{20}$ m, quickly drying, algae; water clear, greyish (brackish); 13 VII 1949.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Plectonema nostocorum Born. ex Gom. — det. F. Drouet.

Calothrix parietina (Naeg.) Thuret ex Born. & Flah. — det. F. Drouet.

Lyngbya versicolor (Wartm.) ex Gom., some — det. F. Drouet.

St. Martin

- 527 MOLLY BEDAY, island, small puddle on top of 25 m high cliff, natural depression in solid andesitic rock, $\frac{1}{5} \times \frac{1}{10} \times \frac{1}{50}$ m, with very thin coating of algae; water clear, colourless, Cl estimated at 800—1000 mg/l (brackish);

Phormidium foveolarum (Mont.) ex Gom., fairly numerous, filaments twisted, trichomes 1.5—2 μ diam., cells somewhat shorter than the diameter — fig. 61.

- 529a OLD BATTERY CISTERN, SE of Philipsburg, remnants of old cistern, 2 m deep, temporarily filled with ground water, $10 \times 2 \times 1$ m, plant debris, dense growth of algae; water clear, Cl estimated at about 200 mg/l (brackish), 17 III 1937.

Nostoc linckia (Roth) Born. ex Born. & Flah., abundant, filaments much twisted, crowded, 4 μ diam., arthrospores 7.5 μ diam. — fig. 32.

Together with *Oedogonium howardii* G. S. West (Van den Hoek, p. 594).

- 530 CRAB HOLE CISTERN, E of Philipsburg, cistern of brick work, $10 \times 6 \times \frac{1}{2}$ m, with some mud and plant decay; water clear, colourless, pH 8.7, Cl 9920 mg/l (brackish); 18 V 1949.

Entophysalis conferta (Kütz.) Drouet & Daily, abundant, cells ellipsoid or clavate, 4—9 μ diam., up to 14—18 μ long — fig. 13.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., numerous.
Together with abundant *Rhizoclonium implexum* (Dillw.) Kütz., dense growth of Ruppia.

- 531 ROLANDS CANAL, Upstreet, small puddle in old ditch, $5 \times 1 \times \frac{1}{120}$ m, among rock debris and grasses; water clear, yellowish brown, Cl estimated at about 1500 mg/l (brackish); 25 V 1949.

Anacystis montana (Lightf.) Drouet & Daily, numerous, cells 6μ diam..

Nostoc spec., sterile, numerous.

- 538 DOCTOR'S WELL on Rockland, Cul de Sac, artificial well with stone wall, 2 m deep, in pasture, $2\frac{1}{2} \times 2\frac{1}{2} \times 1$ m, mud with plant decay, considerable growth of algae; water clear, colourless, pH 8, HCO_3 1130 mg/l, total hardness 32 Germ. $^\circ$, Cl 355 mg/l (brackish); 24 V 1949.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant, filaments 10–18 μ diam., trichomes 9–11 μ diam..

Together with *Rhizoclonium riparium* (Roth) Harvey (= *Rh. hieroglyphicum* (Ag.) Kütz., Van den Hoek, p. 594), *Pithophora*, *Oedogonium* and *Diatomeae*.

- 538a Same locality, Cl 430 mg/l (brackish); 29 VI 1955.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., abundant.

Together with *Rhizoclonium riparium* (Roth) Harv. (= *Rh. hieroglyphicum* (Ag.) Kütz., Van den Hoek, p. 594), *Pithophora polymorpha* (Van den Hoek, p. 594), *Oedogonium*.

- 538A Same locality, cemented trough, filled from the Doctor's Well, $5 \times 1 \times \frac{1}{2}$ m, some plant decay, coating and flakes of algae; water rather clear, almost colourless, Cl estimated at about 500–700 mg/l (brackish); 24 V 1949.

Anacystis montana (Lightf.) Drouet & Daily, abundant, cells 2–5 diam..

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, filaments 14 μ diam., trichomes 13 μ diam..

Together with *Oedogonium*, *Diatomeae*.

- 539 PUDDLE NEAR DOCTOR'S WELL, very small puddle in artificial depression in marshy part of pasture, trampled by cattle, $\frac{1}{5} \times \frac{1}{10} \times \frac{1}{100}$ m; water slightly turbid and coloured, pH about 8, HCO_3 850 mg Cl/l, total hardness 18 Germ. $^\circ$, Cl 635 mg/l (brackish); 24 V 1949.

Anacystis montana (Lightf.) Drouet & Daily, abundant, cells 3–45 μ diam., 3–5 μ long.

Anacystis dimidiata (Kütz.) Drouet & Daily, few, cells 9 μ diam., 16 μ long — fig. 8.

Calothrix parietina Thuret ex Born. & Flah., fairly numerous.
Anabaena spec., sterile.

Lyngbya aestuarii (Mert.) Liebm. ex Gom., fairly numerous, filaments 13–15 μ diam., sheaths thin, trichomes 10–14 μ diam., cells 2 μ long.

Lyngbya martensiana Menegh. ex Gom., fairly numerous, filaments 9—12 μ diam., trichomes 8—9 μ diam., cells 4.5 μ long.

Phormidium tenue (Menegh.) ex Gom., abundant, filaments twisted, sheaths very narrow, trichomes 1.5—2 μ diam., constricted at the transverse walls, cells 3—4 μ long.

Oscillatoria chlorina Kütz. ex Gom., abundant, trichomes fairly short (90 μ) to long, finely transversely striped, cells 3.5—4 μ diam., as long as the diameter or somewhat shorter or longer — *fig. 74*. Together with *Rhizoclonium riparium* (Roth) Harv. (= *Rh. hieroglyphicum* (Ag.) Kütz., Van den Hoek, p. 594), *Oocystis*, *Oedogonium*, *Diatomeae*.

T i n t a m a r r e

- 526A FLAT ISLAND WELL, concrete trough at deep well, $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$ m, flakes of algae; water clear, somewhat coloured, Cl estimated at about 6000—9000 mg/l (brackish); 20 VI 1949.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Anacystis thermalis (Menegh.) Drouet & Daily — det. F. Drouet.

A n g u i l l a

- 545 SPRING NEAR BEDNEY'S at Maze Bay, overflowing puddle ($1 \times \frac{1}{2} \times \frac{1}{20}$ m, limestone detritus, soft mud with some algae; water clear and colourless, pH 7.7, Cl 4960 mg/l (brackish); 18 VI 1949.

Anacystis montana (Lightf.) Drouet & Daily — det. F. Drouet.

Anacystis thermalis (Menegh.) Drouet & Daily — det. F. Drouet.

Plectonema nostocorum Born. ex Born. & Flah. — det. F. Drouet.

Scytonema myochrous (Dillw.) Ag. ex Born. & Flah., some — det. F. Drouet.

Calothrix parietina (Naeg.) Thuret ex Born. & Flah. — det. F. Drouet.

Together with *Chara*.

S t . T h o m a s

- 687 BROOKMAN RIVER, at bridge, very small pools in rivulet, narrowly connected by flowing water, rock debris, concrete, plant decay, much *Enteromorpha* and other algae; water clear, colourless, 28°C, Cl 510 mg/l (brackish); 17 VI 1955.

Nostoc linckia (Roth) Born. ex Born. & Flah. — det. F. Drouet.

Lyngbya aestuarii (Mert.) Liebm. ex Gom. — det. F. Drouet.

Oscillatoria princeps Vauch. ex Gom. — det. F. Drouet.

BAHAMAS

N e w P r o v i d e n c e

- 547 PALL'S WATERWORKS, W of Nassau, trench in weathered limestone and sandy debris, $100 \times 1\frac{1}{5} \times 1\frac{1}{5}$ m, filled by water pumped from deep wells, thick masses of algae; water clear, colourless, HCO_3 305 mg/l, total hardness 15 Germ.°, Cl 300 mg/l (brackish); 23 VIII 1949.

Scytonema myochrous (Dillw.) Ag. ex Born. & Flah. — det. F. Drouet.

Scytonema mirabile (Dillw.) Born. — det. F. Drouet.
Together with *Utricularia*.

South Bimini

- 549 'FOUNTAIN OF YOUTH', muddy hole in limestone, $1 \times 1 \times 1\frac{1}{100}$ m, $1\frac{1}{2}$ m deep, thick layer of mud with leaf decay; water rather clear, almost colourless, HCO_3 510 mg/l, total hardness 14 Germ. $^\circ$, Cl 475 mg/l (brackish); 20 VIII 1949.

Oscillatoria okenii Ag. ex Gom. — det. F. Drouet.

LIST OF THE SPECIES WITH NOTES ON THEIR ECOLOGY AND DISTRIBUTION

CHROOCOCCALES R. v. Wettstein

CHROOCOCCACEAE Naeg.

Coccochloris Sprengel

Coccochloris stagnina Spreng.; Drouet & Daily (p. 15) — *Aphanothece stagnina* (Spreng.) A. Braun — fig. 1—2.

Ecology: see Drouet & Daily (p. 19).

Distribution: cosmopolitan (Drouet & Daily, p. 19—28); *Antilles and adjacent regions*: Venezuela (553), Aruba (104Bc), Curaçao (65A, 74, 397a), Bonaire (60b, 379a, 379b, 379c), St. Eustatius (506); Brazil, Puerto Rico, Jamaica, Florida, Guatemala, Honduras, Nicaragua, Panama (Drouet & Daily, p. 23—26); St. Croix (Frémy, 1939, p. 7).

Coccochloris elabens (Bréb.) Drouet & Daily (p. 28) — *Microcystis elabens* (Bréb.) Kütz. — fig. 3.

Ecology: see Drouet & Daily (p. 29).

Distribution: cosmopolitan (Drouet & Daily, p. 29—31); *Antilles and adjacent regions*: Venezuela (s.n.), Barbuda (667); Brazil, Bonaire, Klein Bonaire, Puerto Rico, Jamaica, South Caicos, New Providence, Florida (Drouet & Daily, p. 30—31).

Coccochloris peniocystis (Kütz.) Drouet & Daily (p. 31) — *Aphanothece saxicola* Naeg. — fig. 4.

Ecology: see Drouet & Daily (p. 33).

Distribution: cosmopolitan (Drouet & Daily, p. 33—34); *Antilles and adjacent regions*: Venezuela (553); St. Vincent, Puerto Rico, Great Bahama, Florida, Honduras (Drouet & Daily, p. 33—34).

Anacystis Menegh.

Anacystis montana (Lightf.) Drouet & Daily (p. 45) — *Gloeocapsa rupestris* Kütz. — *Gloeocapsa punctata* Naeg. — fig. 5.

Ecology: see Drouet & Daily (p. 52).

Distribution: cosmopolitan (Drouet & Daily, p. 53—66); *Antilles and adjacent regions*: Aruba (93b, 104Ba), Curaçao (75, 75a, 79B,

391), Bonaire (48, 381), Klein Bonaire (63c), Margarita (18, s.n.), Los Testigos (165), St. Eustatius (511A), St. Martin (531, 538A, 539), Tintamarre (526A), Anguilla (545); Brazil, Venezuela, St. Vincent, Dominica, Guadeloupe, Puerto Rico, Jamaica, Andros, New Providence, Florida, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, (Drouet & Daily, p. 59—65); St. Croix (Frémy, 1939, p. 7).

Anacystis dimidiata (Kütz.) Drouet & Daily (p. 70) — *Chroococcus turgidus* (Kütz.) Naeg. — fig. 6—8.

Ecology: see Drouet & Daily (p. 71).

Distribution: cosmopolitan (Drouet & Daily, p. 72—75); *Antilles and adjacent regions*: Aruba (93b), Bonaire (48, 379b, 628A), St. Martin (539); Brazil, Venezuela, Puerto Rico, Jamaica, South Caicos, Andros, Bimini, Florida, Guatemala, Costa Rica, Panama (Drouet & Daily, p. 73—75); Guadeloupe (Feldmann, p. 28).

Anacystis thermalis (Menegh.) Drouet & Daily (p. 77) — *Chroococcus cohaerens* (Bréb.) Naeg. — *Chroococcus pallidus* Naeg..

Ecology: see Drouet & Daily, p. 79.

Distribution: cosmopolitan (Drouet & Daily, p. 79—83); *Antilles and adjacent regions*: Curaçao (86), Bonaire (379a), Tintamarre (526A), Anguilla (545); Brazil, Venezuela, Puerto Rico, Florida, Honduras, Nicaragua, Panama (Drouet & Daily, p. 80—82).

Johannesbaptistia J. de Toni

Johannesbaptistia pellucida (Dickie) W. R. Taylor & Drouet; Drouet & Daily (p. 85) — fig. 9—10.

Ecology: see Drouet & Daily (p. 85).

Distribution: Europe, America, Malay Archipelago (Drouet & Daily, p. 85—86); *Antilles and adjacent regions*: Bonaire (48, 628A); Brazil, Virgin Islands, Puerto Rico, South Caicos, New Providence, Florida, Costa Rica (Drouet & Daily, p. 86).

Agmenellum de Brébisson

Agmenellum quadruplicatum (Menegh.) Bréb.; Drouet & Daily (p. 86) — *Merismopedia punctata* Meyen — *Merismopedia glauca* (Ehrenb.) Kütz..

Ecology: see Drouet & Daily (p. 88).

Distribution: cosmopolitan (Drouet & Daily, p. 88—89); *Antilles and adjacent regions*: Aruba (93b, 104Be), Curaçao (389), Bonaire (379a, 379b); Brazil, Venezuela, Puerto Rico, Andros, Florida (Drouet & Daily, p. 88—89).

Gomphosphaeria Kütz.

Gomphosphaeria aponina Kütz.; Drouet & Daily (p. 98).

Ecology: see Drouet & Daily (p. 98).

Distribution: cosmopolitan (Drouet & Daily, p. 99—100); *Antilles and adjacent regions*: Aruba (93b, 104Bb, 104Be), Klein Curaçao (64), Bonaire (53c); Brazil (Möbius, p. 311); Jamaica, Florida, Guatemala (Drouet & Daily, p. 99).

CHAMAESIPHONACEAE Borzi

Entophysalis Kütz.

Entophysalis deusta (Menegh.) Drouet & Daily (p. 103) — *fig. 16*.

Ecology: see Drouet & Daily (p. 105).

Distribution: cosmopolitan (Drouet & Daily, 105—110); *Antilles and adjacent regions*: Bonaire (53c), Klein Bonaire (63c); Colombia, Venezuela, Bonaire, Klein Bonaire, Guadeloupe, Puerto Rico, Jamaica, South Caicos, Mariguana, Berry Islands, Atwood, Bimini Islands, Florida, Costa Rica, Panama (Drouet & Daily, p. 108—109); St. Croix (Frémy, 1939, p. 6, 9).

Entophysalis conferta (Kütz.) Drouet & Daily (p. 111) — *fig. 11—13*.

Ecology: see Drouet & Daily (p. 113).

Distribution: cosmopolitan (Drouet & Daily, p. 114—119); *Antilles and adjacent regions*: Aruba (104Ba, 104Be), Bonaire (53c), Klein Bonaire (61b), St. Martin (530); Brazil, Barbados, Virgin Islands, Puerto Rico, Jamaica, Berry Islands, Florida, Guatemala, Panama (Drouet & Daily, p. 116—118); Guadeloupe (Feldmann, p. 28); St. Thomas, St. Croix (Frémy, 1939, p. 8—11).

Entophysalis rivularis (Kütz.) Drouet; Drouet & Daily (p. 119) — *Gloeocapsa dermochroa* Naeg. — *Xenococcus rivularis* (Hansg.) Geitler — *fig. 14—15*.

Ecology: see Drouet & Daily (p. 122).

Distribution: cosmopolitan (Drouet & Daily, p. 122—126); *Antilles and adjacent regions*: Venezuela (s.n.), Bonaire (48, 57c); Venezuela, Puerto Rico, Florida, Guatemala, Honduras, El Salvador (Drouet & Daily, p. 124—125).

HORMOGONALES Atkinson

STIGONEMATACEAE Kirchner

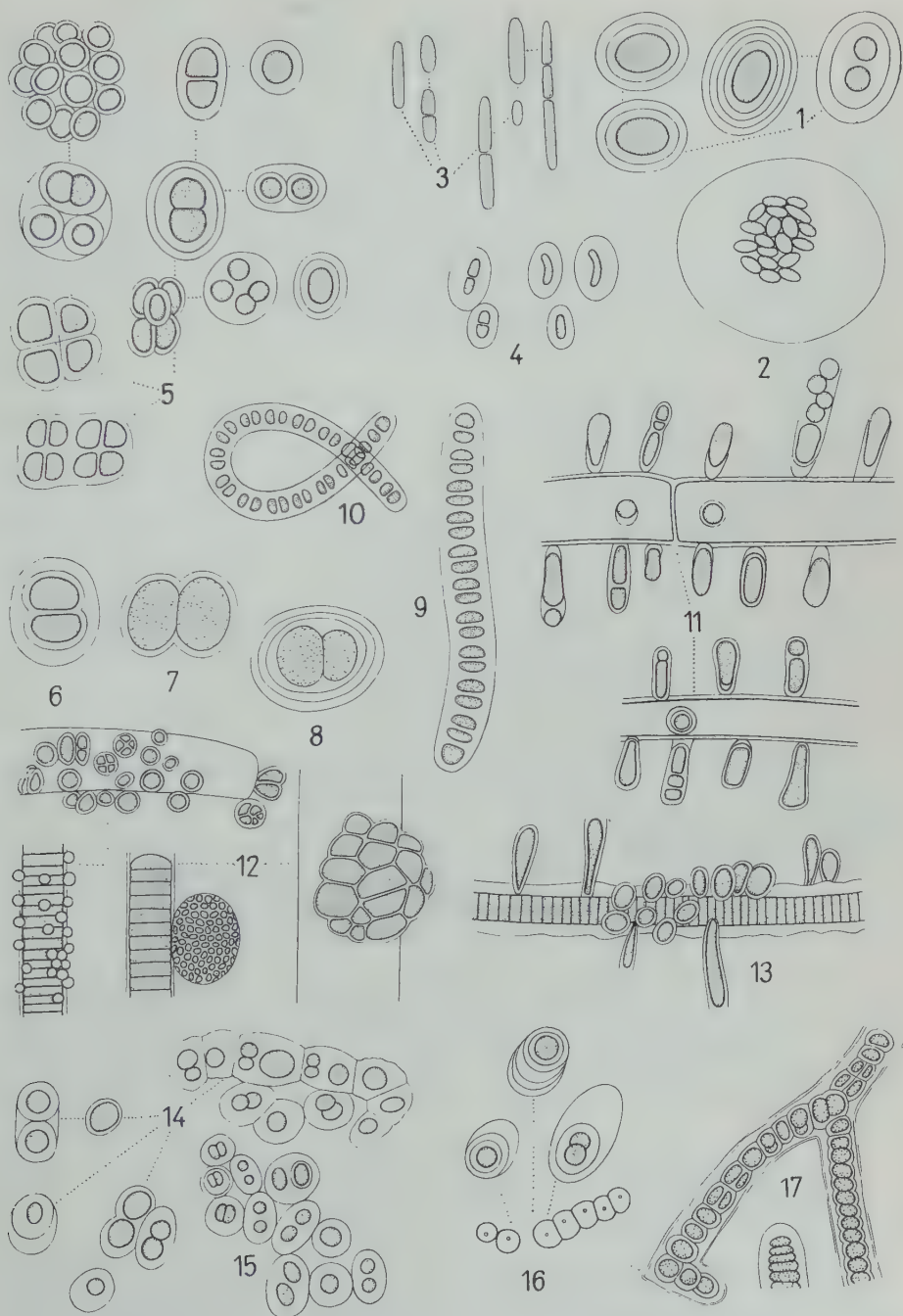
Stigonema Ag. ex Born. & Flah.

Stigonema ocellatum (Dillw.) Thur. ex Born. & Flah. (5, 1887, p. 69) — *fig. 17*.

Ecology: stagnant water, pools, lakes, among mosses on moist soil, attached or floating, acidiphilous (Frémy, 1930, p. 402; Duvigneaud & Symoens, p. 77, Nielsen, 1956, p. 431).

Distribution: cosmopolitan (Frémy, 1930, p. 402); *Antilles and adjacent regions*: Suriname (566); Venezuela (Taylor, 1942, p. 70; Drouet, 1957, p. 684); Guadeloupe (Bourrelly & Manguin, p. 148); Florida (Branon, p. 72; Nielsen, 1956, p. 431).

Fig. 1—17: 1—2. *Coccochloris stagnina*, 1 from Venezuela (553), 2 from Bonaire (379a); 3. *Coccochloris elabens* from Venezuela (s.n.); 4. *Coccochloris penicystis* from Venezuela (553); 5. *Anacystis montana* from Bonaire (48); 6—8. *Anacystis dimidiata*, 6 from Bonaire (48), 7 from Bonaire (379b), 8 from St. Martin (539); 9—10. *Johannesbaptistia pellucida*, 9 from Bonaire (48), 10 from Bonaire (628A); 11—13. *Entophysalis conferta*, 11 from Bonaire (53c), 12 from Klein Bonaire (61b), 13 from St. Martin (530); 14—15. *Entophysalis rivularis*, 14 from Venezuela (s.n.), 15 from Bonaire (48); 16. *Entophysalis deusta* from Klein Bonaire (63c); 17. *Stigonema ocellatum* from Suriname (566).



Hapalosiphon Naeg. in Kütz. ex Born. & Flah.

Hapalosiphon pumilus (Kütz.) Kirchner ex Born. & Flah. (5, 1887, p. 61) — *Hapalosiphon fontinalis* Born. — *fig. 18—19*.

Ecology: stagnant or slowly streaming water, peat-bogs, thermal springs, attached on aquatic plants, wood, rocks, or floating (Frémy, 1930, p. 426; Geitler, 1931, p. 535; Drouet, 1942, p. 108).

Distribution: cosmopolitan (Frémy, 1930, p. 426); *Antilles and adjacent regions:* Suriname (566, 642, 646); Brazil (Drouet, 1959, p. 2); Venezuela (Drouet, 1957, p. 684); Guadeloupe (Bourrelly & Manguin, 1952, p. 147); Puerto Rico (Nielsen, 1956, p. 431); Jamaica (Drouet, 1942, p. 108); Florida (Brannon, 1952, p. 71; Nielsen, 1956, p. 430).

SCYTONEMATACEAE Rabenh. ex Born. & Flah.

Scytonema Ag. ex Born. & Flah.

Scytonema coactile Mont. in Kütz. ex Born. & Flah. (5, 1887, p. 90) — *fig. 20—21*.

Ecology: stagnant and streaming water, ponds, lakes, rivers, brooks, thermal springs, 36° C, at first attached, afterwards floating (Frémy, 1930, p. 300; Bourrelly & Manguin, 1952, p. 149; Nielsen & Madsen, 1956, p. 117).

Distribution: Equatorial Africa, Réunion, India, Antilles, Brazil (Frémy, 1930, p. 300); *Antilles and adjacent regions:* Suriname (566), Nevis (501); Guadeloupe (Bourrelly & Manguin, p. 149), Florida (Brannon, p. 74; Nielsen & Madsen, p. 117); Panama (Drouet, 1937, p. 602).

Scytonema mirabile (Dillw.) Born. in Bull. Soc. Fr. 36, 1889, 155.

Ecology: stagnant water, moist rocks and soil, peat-moor (Frémy, 1930, p. 318; Geitler, 1932, p. 776).

Distribution: cosmopolitan (Frémy, 1930, p. 318); *Antilles and adjacent regions:* New Providence (547); Brazil (Drouet, 1957, p. 2); Guadeloupe (Bourrelly & Manguin, p. 151); Puerto Rico (Gardner, p. 300).

Scytonema myochrous (Dillw.) Ag. ex Born. & Flah. (5, 1887, p. 104).

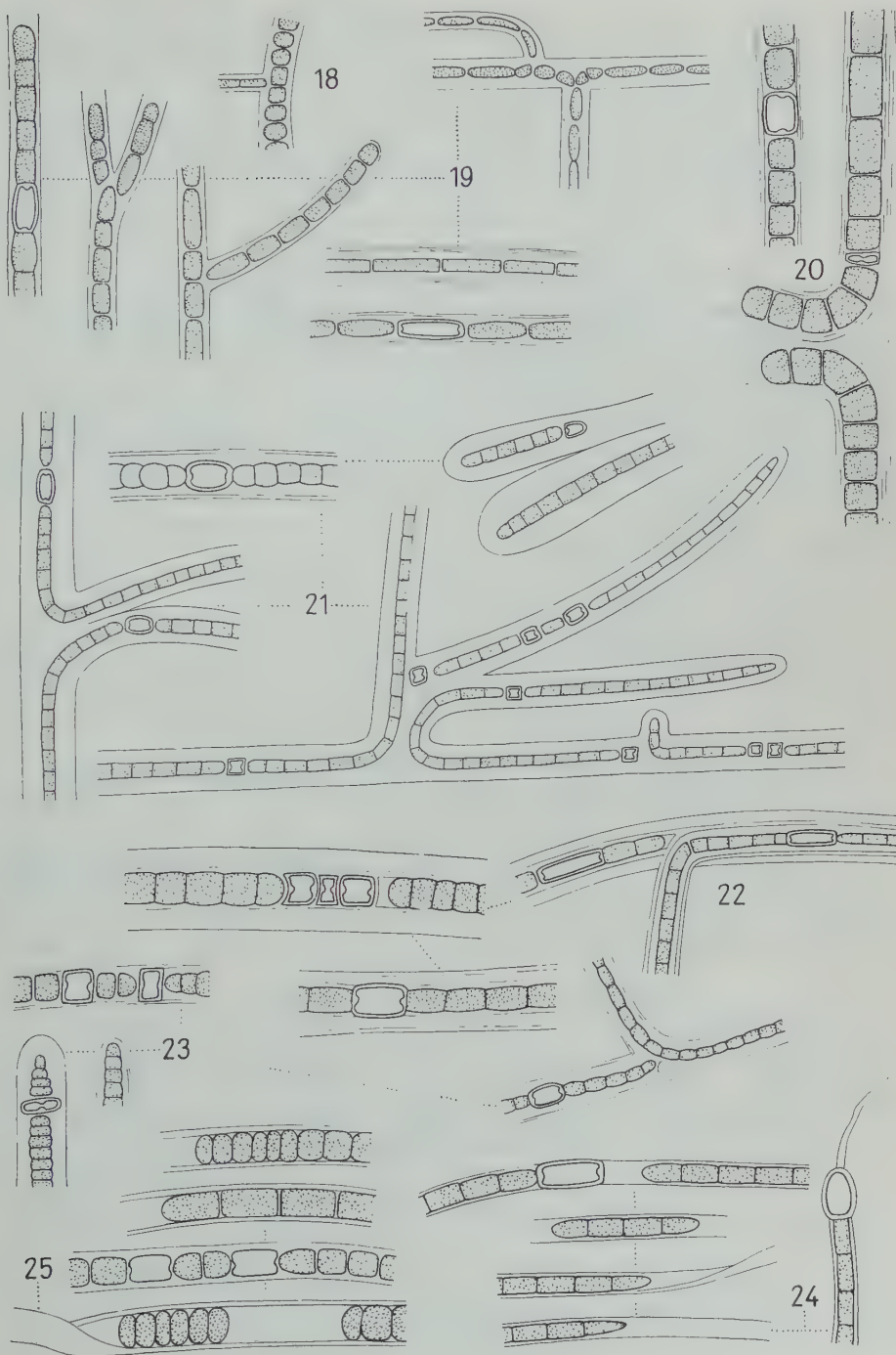
Ecology: rivers, creeks, ravines, swamps, moist rocks, walls, stones and soil, on limestone and dry sand, lake of weak brine on leaves, 32° C. pH 4.8 (Frémy, 1930, p. 321; 1941, p. 148; Bourrelly & Manguin, p. 151; Nielsen & Madsen, p. 123).

Distribution: cosmopolitan (Frémy, 1930, p. 321); *Antilles and adjacent regions:* Anguilla (545); New Providence (547); Brazil (Drouet, 1957, p. 2); Klein Bonaire (Frémy, 1941, p. 148); Guadeloupe (Bourrelly & Manguin, p. 151); Puerto Rico (Gardner, p. 300); Jamaica (Drouet, p. 111); Bahama Islands (Collins, p. 625); Florida (Nielsen & Madsen, p. 123).

Tolypothrix Kütz. ex Born. & Flah.

Tolypothrix lanata (Ag.) Wartm. ex Born. & Flah. (5, 1887, p. 120) — *fig. 22—23*.

Fig. 18—25: 18—19. *Hapalosiphon pumilus*, 18 from Suriname (642), 19 from Suriname (646); 20—21. *Scytonema coactile*, 20 from Nevis (501), 21 from Suriname (566); 22—23. *Tolypothrix lanata*, 22 from Suriname (406), 23 from Suriname (646); 24. *Aulosira laca* from Bonaire (381); 25. *Aulosira implexa* from Margarita (18).



Ecology: stagnant, rarely streaming waters, ponds, lakes, pools, brooks, on immersed stones and roots of trees, borders of fountains, at first attached, afterwards floating (Frémy, 1930, p. 242; Geitler, 1932, p. 717; Brannon, p. 72; Nielsen & Madsen, p. 197).

Distribution: cosmopolitan (Geitler, 1932, p. 717); *Antilles and adjacent regions:* Suriname (406, 646); Puerto Rico (Gardner, p. 303); Florida (Brannon, p. 72; Nielsen & Madsen, p. 197).

Plectonema Thuret ex Bornet

Plectonema nostocorum Born. ex Gom. (16, 1892, p. 102).

Ecology: in sheaths of most gelatinous algae (Drouet, p. 117), pools, lakes, rivers, moist soil, rocks and walls, greenhouses, on limestone and sand (Brannon, p. 77; Nielsen, 1955, p. 87).

Distribution: cosmopolitan (Frémy, 1930, p. 178); *Antilles and adjacent regions:* Curaçao (65A), Barbuda (667), St. Eustatius (511A), Anguilla (545); Venezuela (Drouet, 1957, p. 682); Jamaica (Drouet, p. 117); New Providence (Collins, p. 622); Florida (Brannon, p. 77; Nielsen, 1955, p. 87).

MICROCHAETACEAE Lemmermann

Aulosira Kirchner ex Born. & Flah.

Aulosira laxa Kirchner ex Born. & Flah. (7, 1888, p. 256) — *fig. 24*.

Ecology: stagnant water (Geitler, 1932, p. 675).

Distribution: Europe, India, Java (Geitler, 1932, p. 675); *Antilles and adjacent regions:* Bonaire (381).

Aulosira implexa Born. & Flah. (7, 1888, p. 257) — *fig. 25*.

Ecology: stagnant water, pools, on floating phanerogams (Frémy, 1930, p. 382; Brannon, p. 73).

Distribution: S. America, S. Asia, Madagascar (Frémy, 1930, p. 382); *Antilles and adjacent regions:* Margarita (18); Florida (Brannon, p. 73). This species seems to be restricted to tropical regions.

RIVULARIACEAE Rabenh.

Gloeotrichia J. Ag. ex Born. & Flah.

Gloeotrichia pisum (Ag.) Thur. ex Born. & Flah. (4, 1886, 366).

Ecology: stagnant, sometimes streaming waters, on phanerogams or floating (Frémy, 1930, p. 273; Geitler, 1931, p. 634).

Distribution: cosmopolitan (Frémy, 1930, p. 273); *Antilles and adjacent regions:* Curaçao (397c); Brazil (Drouet, 1957, p. 2).

Gloeotrichia natans (Hedw.) Rabenh. ex Born. & Flah. (4, 1886, p. 369).

Ecology: stagnant, also slightly brackish waters, culvert, attached on leaves or floating (Frémy, 1930, p. 278; Geitler, 1931, p. 639; Brannon, p. 73).

Distribution: cosmopolitan (Frémy, 1930, p. 278); *Antilles and adjacent regions:* Colombia, La Goajira (114); Brazil (Drouet, 1957, p. 2); Jamaica (Drouet, 1942, p. 110); Florida (Brannon, p. 73).

Rivularia (Roth) Ag. ex Born. & Flah.

Rivularia haematites (DC.) Ag. ex Born. & Flah. (4, 1886, p. 350) — *fig. 26.*

Ecology: stagnant, less common streaming waters, on limestone rocks, on banks of lakes (Geitler, 1931, p. 653).

Distribution: Europe, Algeria, N. America, Ecuador (Gauthier-Lièvre, p. 230; Geitler, 1931, p. 654); *Antilles and adjacent regions:* Curaçao (80Aa, 391), Klein Bonaire (63c).

Calothrix Ag. ex Born. & Flah.

Calothrix parietina (Naeg.) Thur. ex Born. & Flah. (3, 1886, p. 366).

Ecology: moist soil, stones and wood, rocks in the upper part of the intertidal zone; basins of fountains, sometimes epiphytic on aquatic plants or endophytic in other algae (Fan, p. 159).

Distribution: cosmopolitan (Fan, p. 161—168); *Antilles and adjacent regions:* Curaçao (391), St. Eustatius (511A), St. Martin (539), Anguilla (545); Aruba, Curaçao (Frémy, 1941, p. 147); Brazil, Barbados, Puerto Rico, Haiti, Jamaica, Bimini, Florida, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama (Fan, p. 161—168).

Calothrix braunii Born. & Flah. (3, 1886, 368) — *fig. 27.*

Ecology: stagnant and streaming waters, on stones, immersed wood, shells and aquatic phanerogams (Frémy, 1930, p. 257; Geitler, 1931, p. 606).

Distribution: Europe, Africa, N. America (Frémy, 1930, p. 257); *Antilles and adjacent regions:* Bonaire (48); Klein Bonaire (Frémy, 1941, p. 147); Puerto Rico (Gardner, p. 305).

Dichothrix Zanard. ex Born. & Flah.

Dichothrix orsiniana (Kütz.) ex Born. & Flah. (3, 1886, p. 376) — *fig. 28.*

Ecology: on stones and rocks in rapidly streaming water, less common in stagnant waters, moist rocks (Frémy, 1930, p. 270; Geitler, 1931, p. 588).

Distribution: Europe, Africa, Central Asia, India, N. America (Frémy, 1930, p. 270); *Antilles and adjacent regions:* Margarita (s.n.).

Amphithrix Born. & Flah.

Amphithrix janthina (Mont.) ex Born. & Flah. (3, 1886, p. 344).

Ecology: streaming water, brooks, border of fountain, on immersed stones (Frémy, 1930, 242).

Distribution: Europe, Africa, N. America (Frémy, 1930, p. 242); *Antilles and adjacent regions:* Curaçao (399); Brazil (Drouet, 1957, p. 1).

NOSTOCACEAE Kirchner

Anabaena Bory ex Born. & Flah.

Anabaena variabilis Kütz. ex Born. & Flah. (7, 1888, p. 226) — *fig. 29—30.*

Ecology: stagnant, also brackish waters, moist soil, decayed wood, attached or floating (Frémy, 1930, p. 361, Brannon, p. 72).

Distribution: cosmopolitan (Frémy, 1930, p. 361); *Antilles and adjacent regions*: Aruba (102A), Bonaire (45); Florida (Brannon, p. 72).

Anabaena sphaerica Born. & Flah. (7, 1888, p. 228).

Ecology: stagnant waters (Frémy, 1930, p. 361).

Distribution: Europe, W. Africa, Java, New-Guinea, N. America (Frémy, 1930, p. 361); *Antilles and adjacent regions*: Aruba (102A); Florida (Brannon, p. 72).

Anabaena spiroides Klebahn in Flora, 89, 1805, 268.

Ecology: stagnant waters, planctonic (Frémy, 1930, p. 361).

Distribution: Europe, Equatorial Africa, India, N. America (Frémy, 1930, p. 361); *Antilles and adjacent regions*: Aruba (641); Florida (Brannon, p. 72).

Nodularia Mertens ex Born. & Flah.

Nodularia spumigena Mertens ex Born. & Flah. (7, 1888, 245) — fig. 31.

Ecology: stagnant, also brackish waters, decayed wood, attached or floating (Geitler, 1932, p. 866; Brannon, p. 72).

Distribution: cosmopolitan (Geitler, 1932, 866); *Antilles and adjacent regions*: Aruba (641); Florida (Brannon, p. 72).

Nostoc Vaucher ex Born. ex Flah.

Nostoc linckia (Roth) Born. & Flah. (7, 1888, p. 192) — fig. 32.

Ecology: stagnant, also brackish waters, attached at first, afterwards floating (Frémy, 1930, p. 34).

Distribution: cosmopolitan (Frémy, 1930, p. 334); *Antilles and adjacent regions*: St. Martin (529a), St. Thomas (687); Bonaire, Klein Bonaire (Frémy, 1941, p. 149); Guadeloupe (Bourrelly & Manguin, p. 155); Florida (Brannon, p. 73).

Nostoc sphaericum Vauch. ex Born. & Flah. (7, 1888, p. 208) — fig. 33—34.

Ecology: among mosses on moist rocks and stumps, sometimes in stagnant waters, on aquatic plants (Frémy, 1930, p. 345; Geitler, 1932, p. 850).

Distribution: cosmopolitan (Frémy, 1930, p. 345); *Antilles and adjacent regions*: Curaçao (68); Bonaire (52, 378, 381); Bonaire (Frémy, 1941, p. 149); Puerto Rico (Gardner, p. 293).

OSCILLATORIACEAE Kirchner

Microcoleus Desmazières ex Gom.

Microcoleus chthonoplastes (Fl. Dan.) Thur. ex Gom. (15, 1892, p. 353).

Ecology: brackish waters and soil, lakes and pools of weak brines, of concentrated seawater, and of oversalted seawater, seashores, tidal flats, calcareous sand, sometimes in freshwater (Frémy, 1930, p. 781; 1941, p. 139; Drouet, 1942, p. 117; Geitler, 1932, p. 1133; Taylor, 1942, p. 71).

Distribution: cosmopolitan (Frémy, 1930, p. 781); *Antilles and adjacent region*: Curaçao (80 A b), Bonaire (57d, 60b, 381), Tobago (656 A); Brazil (Gomont, p. 354; Möbius, p. 312), Aruba (Taylor, 1942, p. 71); Bonaire, Klein Bonaire (Frémy, 1941, p. 139); Guadeloupe (Bourrelly & Manguin,

p. 156; Feldmann, p. 28); St. Croix (Frémy, 1939, p. 16); Jamaica (Drouet, 1942, p. 117); Cuba (Montagne, p. 8); Panama (Taylor, 1942, p. 72).

Microcoleus tenerrimus Gom. (15, 1892, p. 355).

Ecology: seashores, rock-pools, inland salt-marshes, brines, roots of *Rhizophora* (Geitler, 1932, p. 1135; Frémy, 1941, p. 139; Feldmann, p. 28).

Distribution: Europe, N. Africa, Malay Archipelago, Australia, N. America (Geitler, 1932, p. 1135); *Antilles and adjacent regions*: Tobago (656 A); Bonaire (Frémy, 1941, p. 139); Guadeloupe (Feldmann, p. 28); St. Croix (Frémy, 1939, p. 15).

Microcoleus cavanillesii (Guerrero in An. Jard. Bot. Madrid 6 (1945) 1946, p. 270 — fig. 35.

Ecology: salines (Guerrero l.c.).

Distribution: Spain (Guerrero l.c.); *Antilles and adjacent regions*: Bonaire (44 A a).

Schizothrix Kütz. ex Gom.

Schizothrix calcicola (Ag.) ex Gom. (15, 1892, p. 307) — fig. 36.

Ecology: moist rocks and walls, thermal springs, greenhouses (Geitler, 1932, p. 1084).

Distribution: cosmopolitan (Geitler, 1932, p. 1084); *Antilles and adjacent regions*: Curaçao (389); Venezuela (Drouet, 1957, p. 682); Florida (Brannon, p. 78).

Schizothrix lardacea (Ces.) ex Gom. (15, 1892, p. 311) — fig. 37.

Ecology: moist rocks, walls, stones and soil, springs, sometimes in brackish water (Frémy, 1930, p. 92; 1941, p. 140).

Distribution: cosmopolitan (Frémy, 1930, p. 92); *Antilles and adjacent regions*: Bonaire (48); Curaçao (Frémy, 1941, p. 140); Guadeloupe (Bourelly & Manguin, p. 157).

Schizothrix heufleri Grun. ex Gom. (15, 1892, p. 325).

Ecology: moist rocks (Geitler, 1932, p. 1106).

Distribution: Tirol, Iceland (Geitler, 1932, p. 1106); *Antilles and adjacent regions*: Curaçao (74).

Schizothrix vaginata (Naeg. in Kütz.) ex Gom. (15, 1892, p. 302) — fig. 38.

Ecology: fresh and brackish, stagnant and streaming waters, moist stones (Frémy, 1930, p. 96; Geitler, 1932, p. 1091).

Distribution: Europe, Equatorial Africa, Malay Archipelago, India, Oceania (Frémy, 1930, p. 96; Geitler, 1932, p. 1091); *Antilles and adjacent regions*: Bonaire (52d); New Providence, Caicos Islands (Collins, p. 623).

Lyngbya Ag. ex Gom.

Lyngbya kuetsingii Schmidle in Allg. Bot. Zeitschr. 1897, 58 — fig. 39.

Ecology: stagnant waters, on filamentous algae (Frémy, 1930, p. 195).

Distribution: cosmopolitan (Frémy, 1930, p. 195); *Antilles and adjacent regions*: Bonaire (52e, 53e), Klein Bonaire (61b); Klein Bonaire (Frémy, 1941, p. 143); Puerto Rico (Gardner, p. 273).

Lyngbya lagerheimii (Möbius) ex Gom. (16, 1892, p. 147) — fig. 40-41.

Ecology: stagnant waters, lakes, ponds, on aquatic plants and rocks, planctonic (Frémy, 1930, p. 202; Nielsen, 1955, p. 109).

Distribution: Europe, Africa, Java, N. and S. America (Frémy, 1930, p. 202; Geitler, 1932, p. 1044); *Antilles and adjacent regions:* Curaçao (89), Bonaire (379c, 379b, 379e); Brazil (Gomont, p. 148); Barbados (West, p. 291); Puerto Rico (Gardner, p. 275); Florida (Nielsen, 1955, p. 109); Caicos Islands (Collins, p. 622); Guatemala (Taylor, 1939, p. 115); Panama (Drouet, 1937, 604).

Lyngbya aestuarii (Mert.) Liebm. ex Gom. (16, 1892, p. 127) — *fig. 42—46.*

Ecology: brackish and less commonly freshwater, tidal flats, thermal waters, shores, lakes of weak or rather strong brine, of oversalted seawater, on logs, stones, coral debris, roots of Rhizophora, attached or floating, 30°C. (Frémy, 1930, p. 183; 1941, p. 141; Geitler, 1932, p. 1052; Drouet, 1942, p. 118; Brannon, p. 74).

Distribution: cosmopolitan (Frémy, 1930, p. 183); *Antilles and adjacent regions:* Suriname (406, 642), Aruba (102 A, 104 A, 104 B a, 638, 641), Curaçao (75, 88a, 89, 398), Klein Curaçao (64, 387), Bonaire (44, 45, 48, 53c, 58b, 60b, 628, 628 A), Klein Bonaire (61b), Tobago (656 A). Nevis (500, 501, 502), St. Martin (530, 538, 538a, 538 A, 539), St. Thomas (687); Venezuela (Drouet, 1957, p. 681); Aruba, Curaçao, Bonaire, Klein Bonaire (Frémy, 1930, p. 141); Barbados (West, p. 291); Guadeloupe (Bourrelly & Manguin, p. 157; Feldmann, p. 31); St. John, St. Thomas, St. Croix (Frémy, 1939, p. 27); Puerto Rico (Gardner, p. 26); Jamaica (Drouet, 1942, p. 118); Exuma Chain (Collins, p. 622); Florida (Brannon, p. 74); Panama (Taylor, 1942, p. 73).

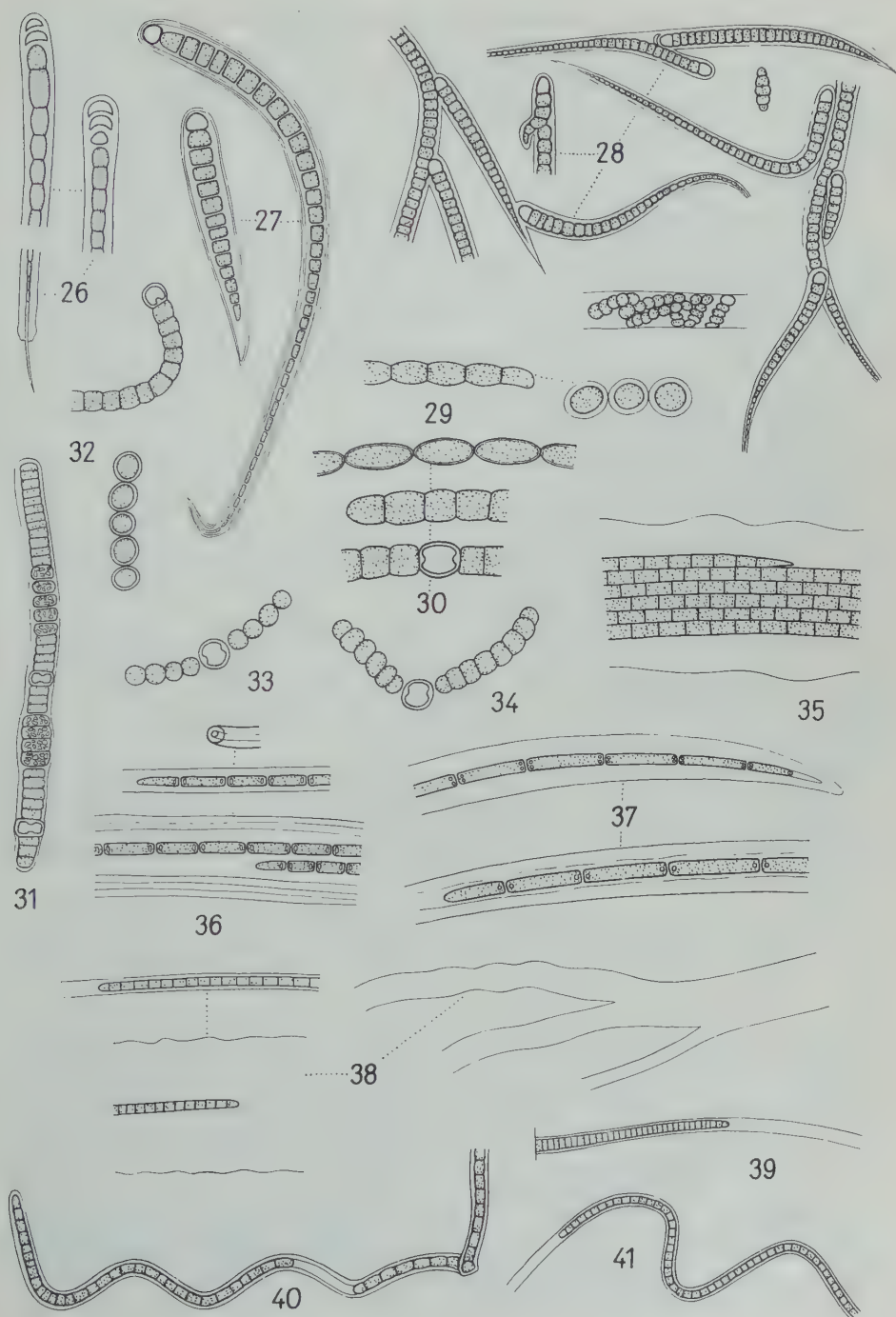
Lyngbya lutea (Ag.) ex Gom. (16, 1892, p. 141) — *fig. 47.*

Ecology: brackish and thermal waters, pools, ponds, bays, rivers, estuaries, swamps, rock springs, sulphur spring, lakes of weak or rather strong brine, seawater streaming into lake, very concentrated salt-pan, between corals on tidal flats, on submerged limestone, on roots of mangroves, on rocks and wood wet by freshwater (West, p. 291; Frémy, 1930, p. 189; 1941, p. 142; Nielsen, 1955, p. 107).

Distribution: Europe, N. Africa, Madagascar, N. America (Frémy, 1930, p. 189); *Antilles and adjacent regions:* Aruba (104 A); Aruba, Curaçao, Bonaire (Frémy, 1941, p. 142); Guadeloupe (Feldmann, p. 31); St. Thomas, St. Croix (Frémy, 1939, p. 30); Puerto Rico (Gardner, p. 275); Florida (Nielsen, 1955, p. 107).

Lyngbya diguetii Gom. in Harriot in Journ. de Bot. 9, 1895, p. 169 — *fig. 48.*

Fig. 26—41: 26. *Rivularia haematites* from Klein Bonaire (63c); 27. *Calothrix braunii* from Bonaire (48); 28. *Dichothrix orsiniana* from Margarita (s.n.); 29—30. *Anabaena variabilis*, 29 from Aruba (102A), 30 from Bonaire (45); 31. *Nodularia spumigena* from Aruba (641); 32. *Nostoc linckia* from St. Martin (529a); 33—34. *Nostoc sphaericum*, 33 from Bonaire (52), 34 from Bonaire (378); 35. *Microcoleus cavanillesii* from Bonaire (44Aa); 36. *Schizothrix calcicola* from Curaçao (389); 37. *Schizothrix lardacea* from Bonaire (48); 38. *Schizothrix vaginata* from Bonaire (52d); 39. *Lyngbya kuetzingii* from Bonaire (52e); 40—41. *Lyngbya lagerheimii*, 40 from Curaçao (89), 41 from Bonaire (379c).



Ecology: stagnant waters, on immersed plants and insects (Frémy, 1930, p. 197).

Distribution: Sweden, Equatorial Africa, California, Uruguay (Frémy, 1930, p. 197); *Antilles and adjacent regions:* Curaçao (66), Bonaire (58b, 58c); Curaçao, Bonaire (Frémy, 1941, p. 142); Florida (Brannon, p. 75).

Lyngbya versicolor (Wartm.) ex Gom. (16, 1892, p. 147).

Ecology: stagnant fresh and brackish waters, creeks, lakes, aquarium, basin of fountain, bird bath, water reservoir (Frémy, 1930, p. 198; Drouet, 1942, p. 119; Nielsen, 1955, p. 108).

Distribution: Europe, Africa, Ceylon, Australia, N. America (Frémy, 1930, p. 198); *Antilles and adjacent regions:* Curaçao (398), Klein Curaçao (387), St. Eustatius (511 A); Barbados (West, p. 291); Jamaica (Drouet, 1942, p. 119); Florida (Nielsen, 1955, p. 108).

Lyngbya allorgei Frémy (1930, p. 189) — *fig. 49.*

Ecology: stagnant waters (Frémy, 1930, p. 190); *Antilles and adjacent regions:* Venezuela (553).

Lyngbya confervoides Ag. ex Gom. (16, 1892, p. 136).

Ecology: harbours, shores, tide pools, lakes of weak brine and of oversalted seawater, seawater flowing into lake, intertidal on stones, rocks, sand, wood, jetties and breakwaters, at high tide mark, on oyster-shells, on sandy coral-debris (Frémy, 1941, p. 142; Drouet, 1942, p. 119; Nielsen, 1955, p. 101).

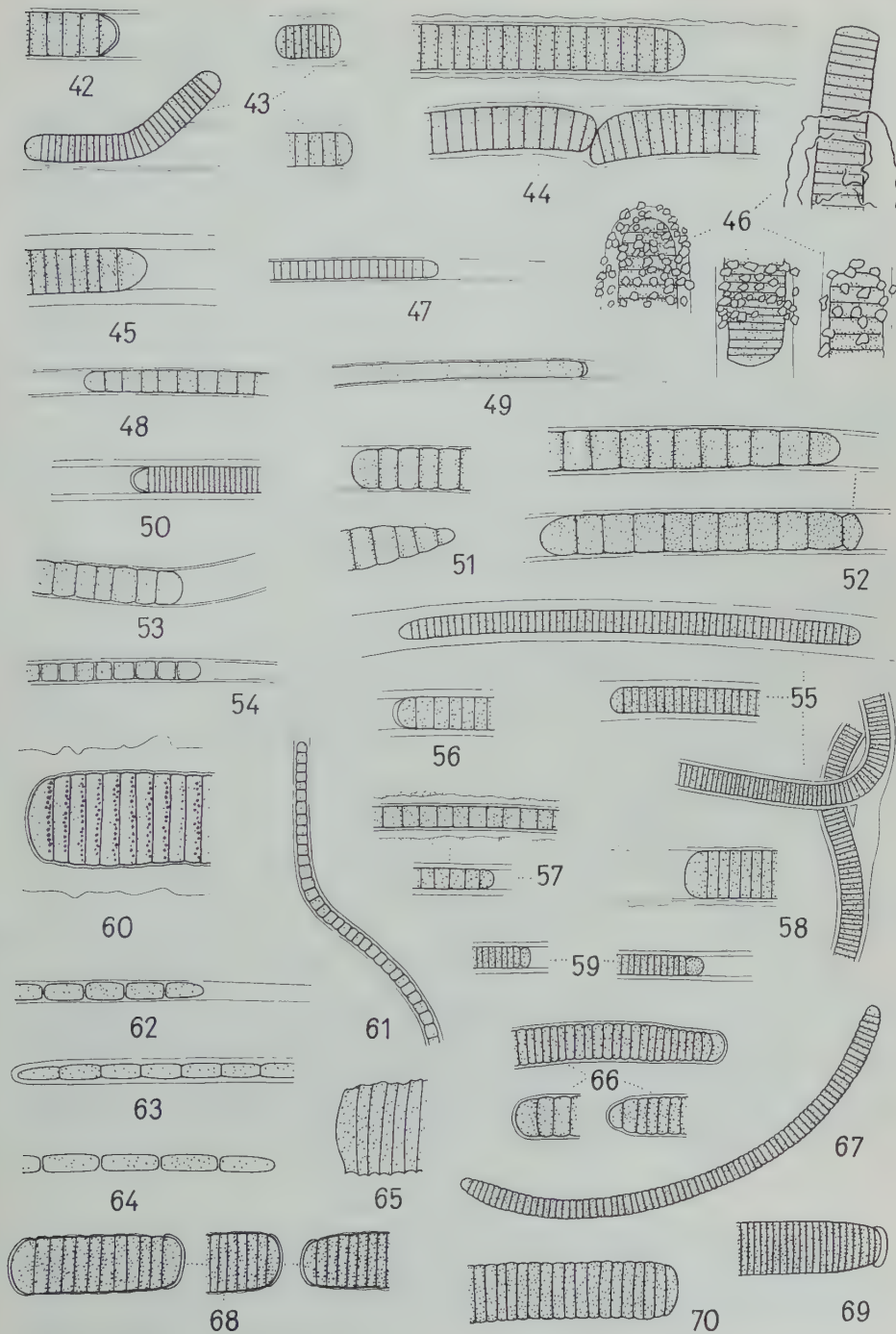
Distribution: cosmopolitan (Geitler, 1932, 1061); *Antilles and adjacent regions:* Tobago (656 A); Bonaire (Frémy, 1942, p. 142); Guadeloupe (Feldmann, p. 32); St. Croix (Frémy, 1939, p. 29); Puerto Rico (Gardner, p. 275); Jamaica (Drouet, 1942, p. 119); Bahama Islands (Collins, p. 622); Florida (Nielsen, 1955, p. 101).

Lyngbya semiplena (Ag.) J. Ag. ex Gom. (16, 1892, p. 138) — *fig. 50.*

Ecology: intertidal on rocks, bridges, shores, mangrove-roots, pilings, mud-flats and jetties, in salt-marshes, seawater streaming into lake, on *Juncus*, 29°, 30°C. (Frémy, 1941, p. 142; Brannon, p. 75; Nielsen, 1955, p. 102).

Distribution: cosmopolitan (Geitler, 1932, p. 1061); *Antilles and adjacent regions:* Aruba (104, 104b, 104 B b), Blanquilla (35); Tobago (656 A); Bonaire (Frémy, 1941, p. 142); Guadeloupe (Feldmann, p. 32);

Fig. 42—70: 42—46. *Lyngbya aestuarii*, 42 from Aruba (104Ba), 43 from Aruba (638), 44 from Bonaire (53c), 45 from Klein Bonaire (61b), 46 from Nevis (500); 47. *Lyngbya lutea* from Aruba (104A); 48. *Lyngbya diguetii* from Bonaire (58c); 49. *Lyngbya allorgei* from Venezuela (553); 50. *Lyngbya semiplena* from Aruba (104b); 51—53. *Lyngbya aerugineo-coerulea*, 51. type (*Oscillatoria aerugineo-coerulea* Kütz.), 52 from Curaçao (89), 53 from Bonaire (44b); 54. *Lyngbya putealis* from Margarita (19); 55—59. *Lyngbya martensiana*, 55 from Aruba (104Be), 56 from Suriname (406), 57 from Bonaire (54b), 58 from Nevis (501), 59 from Bonaire (58c); 60. *Lyngbya major* from Aruba (104Ba); 61. *Phormidium foveolarum* from St. Martin (527); 62—63. *Phormidium tenue*, 62 from Bonaire (58c), 63 from Nevis (502); 64. *Phormidium luridum* from Bonaire (628A); 65. *Oscillatoria bonnemaisonii* from Aruba (104Bb); 66—67. *Oscillatoria sanota*, 66 from Aruba (104), 67 from Bonaire (628A); 68—69. *Oscillatoria limosa*, 68 from Curaçao (399), 69 from Nevis (502); 70. *Oscillatoria obtusa* from Bonaire (379b).



St. John, St. Thomas, St. Croix (Frémy, 1939, p. 29); Puerto Rico (Gardner, p. 276); Bahama Islands (Collins, p. 622); Florida (Brannon, 1952, p. 75; Nielsen, 1955, p. 102).

Lyngbya aerugineo-coerulea (Kütz.) ex Gom. (16, 1892, p. 146) — *fig. 51–53*.

Ecology: stagnant and streaming waters (Geitler, 1932, p. 1062).

Distribution: cosmopolitan (Frémy, 1930, p. 190); *Antilles and adjacent regions*: Curaçao (89), Bonaire (44b, 57c, 58b, 379a, 628 A); Curaçao, Klein Bonaire (Frémy, 1941, 142); Puerto Rico (Gardner, p. 274).

Lyngbya putealis Mont. ex Gom. (16, 1892, p. 143) — *fig. 54*.

Ecology: stagnant fresh, also thermal waters, lakes, ponds, pools, gutters, on mud and stones, border of brooks and fish-ponds, cold spring, pH 7.5 (Frémy, 1930, p. 194; Bourrelly & Manguin, p. 158; Brannon, p. 75).

Distribution: England, Equatorial Africa, Réunion, Madagascar, Ceylon, S. America (Frémy, 1930, p. 194); *Antilles and adjacent regions*: Margarita (19), Tobago (656 A), Nevis (501); Brazil (Drouet, 1957, p. 2); French Guyana (Gomont, p. 144); Guadeloupe (Bourrelly & Manguin, p. 158; Jamaica (Drouet, 1942, p. 119); Florida (Brannon, p. 75).

Lyngbya martensiana Menegh. ex Gom. (16, 1892, p. 145) — *fig. 55–59*.

Ecology: stagnant and streaming, also thermal waters, very rarely marine on shells and Corallinaceae (Frémy, 1930, p. 192; Geitler, 1932, p. 1064).

Distribution: cosmopolitan (Geitler, 1932, p. 1064); *Antilles and adjacent regions*: Suriname (406), Aruba (104 B c), Curaçao (79, 79 B, 83), Bonaire (44, 54b, 58c, 381, 384), Nevis (501), St. Martin (539); Paraguana, Curaçao, Bonaire, Klein Bonaire, Blanquilla, Los Testigos (Frémy, 1941, p. 142); Barbados (West, p. 291); Guadeloupe (Gomont, p. 146); Puerto Rico (Gardner, p. 274).

Lyngbya major Menegh. ex Gom. (16, 1892, p. 144) — *fig. 60*.

Ecology: stagnant, also thermal waters, on mud (Geitler, 1932, p. 1066).

Distribution: Europe, Algeria (Geitler, 1932, p. 1066; Gauthier-Lièvre, p. 227); *Antilles and adjacent regions*: Aruba (104 B a); Barbados (West, p. 291).

Lyngbya taylorii Drouet & Strickland in Amer. Journ. Bot. 27, 1940, p. 631.

Ecology: ponds, lakes, hot springs, ditch in salt-marsh, pilings of bridge, running water, on aquatic plants, rocks and wood, sometimes floating (Strickland, p. 631; Brannon, p. 75; Nielsen, 1955, p. 107).

Distribution: N. America (Strickland, p. 631); *Antilles and adjacent regions*: St. Eustatius (506); Florida (Brannon, p. 75; Nielsen, 1955, p. 107), Guatemala (Strickland, p. 631).

***Phormidium* Kütz. ex Gom.**

Phormidium foveolarum (Mont.) ex Gom. (16, 1892, p. 164) — *fig. 61*.

Ecology: moist soil, stones and calcareous rocks (Frémy, 1930, p. 140; Geitler, 1932, p. 999).

Distribution: Europe, Africa, N. America (Frémy, 1930, p. 140);

Antilles and adjacent regions: St. Martin (527); Puerto Rico (Gardner, p. 278).

Phormidium tenue (Menegh.) ex Gom. (16, 1892, p. 169) — *fig. 62-63*.

Ecology: stagnant, also cold and thermal waters, pools, lakes, gutters, springs, sulphur spring, lakes of weak and of rather strong brine, seawater streaming in lake, moist soil (Frémy, 1930, p. 148; 1941, p. 141; Geitler, 1932, p. 1005; Brannon, p. 77; Nielsen, 1955, p. 180).

Distribution: cosmopolitan (Frémy, 1930, p. 148); *Antilles and adjacent regions*: Bonaire (58c), Margarita (s. n.), Los Testigos (31 A), Nevis (502), St. Martin (539); Venezuela (Drouet, 1957, p. 681); Bonaire (Frémy, 1941, p. 141); Barbados (West, p. 292); Guadeloupe (Bourrelly & Manguin, p. 163); Florida (Brannon, p. 77; Nielsen, 1955, p. 180).

Phormidium luridum (Kütz.) ex Gom. (16, 1892, p. 165) — *fig. 64*.

Ecology: stagnant, also thermal waters, on colonies of *Nostoc* (Geitler, 1932, p. 1010; Bourrelly & Manguin, p. 162).

Distribution: cosmopolitan (Geitler, 1932, p. 1010); *Antilles and adjacent regions*: Bonaire (628 A); Dominica (West, p. 291); Guadeloupe (Bourrelly & Manguin, p. 162); Puerto Rico (Gardner, p. 278).

Phormidium valderianum Gom. (16, 1892, p. 167).

Ecology: stagnant and streaming, also brackish and thermal waters, lages, rivers, sulphur spring, submerged lock, rarely on moist rocks (Frémy, 1930, p. 144; Bourrelly & Manguin, p. 163; Nielsen, 1955, p. 180).

Distribution: cosmopolitan (Frémy, 1930, p. 144); *Antilles and adjacent regions*: Antigua (665); Guadeloupe (Bourrelly & Manguin, p. 163); Puerto Rico (Gardner, p. 279); Jamaica (Drouet, 1942, p. 120); New Providence, North Cat Cay, Walting's Island (Collins, p. 621); Florida Brannon, p. 77; Nielsen, 1955, p. 120).

Phormidium papyraceum (Ag.) ex Gom. (16, 1892, p. 173).

Ecology: stagnant and streaming, also thermal waters, seashores, springs run, on moist soil, walls, stones and wood, salt pond (Frémy, 1930, p. 151; Geitler, 1932, p. 1020; Brannon, p. 77; Frémy, 1939, p. 25).

Distribution: cosmopolitan (Frémy, 1930, p. 151); *Antilles and adjacent regions*: Curaçao (74); Brazil (Drouet, 1957, p. 2); St. Croix (Frémy, 1939, p. 25); Jamaica (Drouet, 1942, p. 120); Florida (Brannon, p. 77; Nielsen, 1955, p. 182); Panama (Drouet, 1937, p. 604).

Phormidium autumnale (Ag.) ex Gom. (16, 1892, p. 187).

Ecology: moist soil, stones, rocks and submerged (also intertidal) woodwork, springs, ponds, swiftly running water, greenhouse, nitrophilous (Frémy, 1930, p. 164; Brannon, p. 77; Nielsen, 1955, p. 185).

Distribution: cosmopolitan (Frémy, 1930, p. 164); *Antilles and adjacent regions*: Curaçao (76 D), Los Testigos (165); Venezuela (Drouet, 1954, p. 681); Florida (Brannon, p. 77; Nielsen, 1955, p. 185).

Oscillatoria Vauch. ex Gom.

Oscillatoria bonnemaisonii Crouan ex Gom. (16, 1892, p. 215) — *fig. 65*.

Ecology: brackish and almost marine waters, shallow pool of concentrated seawater, on walls and rocks on seashores, on roots of *Rhizophora*.

on muddy bottom below mangroves, on sandy coral debris, 30° C. (Geitler, 1932, p. 942; Frémy, 1939, p. 31; 1941, p. 144).

Distribution: Europe, Algeria, Polynesia, N. America (Gauthier-Lièvre, p. 227; Geitler, 1932, p. 942); *Antilles, and adjacent regions*: Aruba (104 B b); Curaçao, Bonaire, Klein Bonaire (Frémy, 1941, p. 144); St. Croix (Frémy, 1939, p. 31); Puerto Rico (Gardner, p. 271); Jamaica (Drouet, 1942, p. 121).

***Oscillatoria sancta* Kütz. ex Gom.** (16, 1892, p. 209) — *fig. 66—67*.

Ecology: stagnant and streaming, also thermal waters, on moist soil, rocks and walls, greenhouses, attached or floating (Frémy, 1930, p. 211; Geitler, 1932, p. 943; Nielsen, 1954, p. 362).

Distribution: Europe, Africa, Australia, N. and S. America, Antarctica (Frémy, 1930, p. 211); *Antilles and adjacent regions*: Aruba (104), Bonaire (628 A); Barbados (West, p. 292); Guadeloupe (Bourrelly & Manguin, p. 161); Puerto Rico (Gardner, p. 267); Atwood Cay (Collins, p. 620); Florida (Nielsen, 1954, p. 362).

***Oscillatoria limosa* Ag. ex Gom.** (16, 1892, p. 210) — *fig. 68—69*.

Ecology: stagnant or slowly streaming, also brackish and polluted waters, ponds, springs, rivers, harbours, on mud, attached or floating (Frémy, 1930, p. 212; Geitler, 1932, p. 944, Brannon, p. 76).

Distribution: cosmopolitan (Frémy, 1930, p. 212); *Antilles and adjacent regions*: Aruba (93b), Curaçao (89, 399), Nevis (502); Barbados (West, p. 292); Puerto Rico (Gardner, p. 267); Florida (Brannon, p. 76; Nielsen, 1954, p. 359).

***Oscillatoria obtusa* Gardn.** (p. 267) — *fig. 70*.

Ecology: stagnant and streaming waters (Gardner, p. 267).

Distribution: *Antilles and adjacent regions*: Bonaire (379a, 379b); Puerto Rico (Gardner, p. 267).

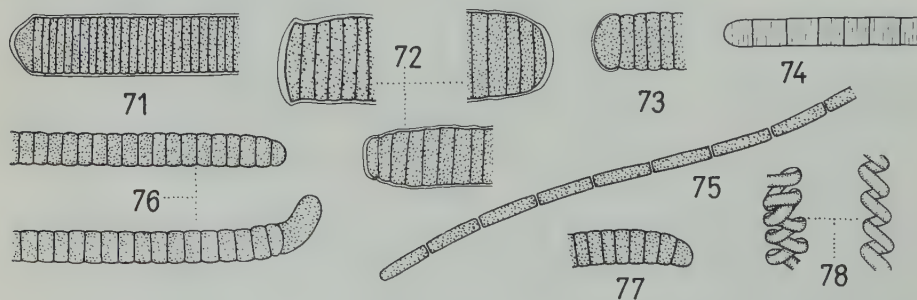


Fig. 71—78: 71—73. *Oscillatoria princeps*, 71 from Aruba (104b), 72 from Bonaire (53c), 73 from Klein Bonaire (61b); 74. *Oscillatoria chlorina* from St. Martin (539); 75. *Oscillatoria limnetica* from Bonaire (44b); 76—77. *Oscillatoria okenii*, 76 from Nevis (502), 77 from Venezuela (553); 78. *Spirulina major* from Curaçao (89).

***Oscillatoria princeps* Vauch. ex Gom.** (16, 1892, p. 206) — *fig. 71—73*.

Ecology: stagnant and slowly streaming, also thermal waters, pools, ponds, rivers, sulphur spring, at first attached on the bottom, afterwards floating (Frémy, 1930, p. 209; Nielsen, 1954, p. 361).

Distribution: cosmopolitan (Frémy, 1930, p. 209); *Antilles and adjacent regions*: Aruba (104b), Curaçao (89, 396c), Bonaire (53c, 61b), St. Thomas (687); Brazil (Gomont, p. 207); Curaçao, Bonaire, Klein Bonaire (Frémy, 1941, p. 144); Barbados (West, p. 292); Guadeloupe (Bourrelly & Manguin, p. 161), Puerto Rico (Gardner, p. 267); Jamaica (Drouet, 1942, p. 121); Florida (Brannon, p. 76; Nielsen, 1954, p. 361).

Oscillatoria chlorina Kütz. ex Gom. (16, 1892, p. 223) — *fig. 74*.

Ecology: stagnant, also brackish and thermal waters, pools, on mud, also floating (Frémy, 1930, p. 215; Geitler, 1932, p. 952; Brannon, p. 76).

Distribution: Europe, Equatorial Africa, N. America, Antarctica (Frémy, 1930, p. 215); *Antilles and adjacent waters*; St. Martin (539); Puerto Rico (Gardner, p. 268); Florida (Brannon, p. 76).

Oscillatoria limnetica Lemmermann in Ber. deutsch Bot. Ges. 18, 1900, p. 310 — *fig. 75*.

Ecology: stagnant, often polluted waters, planctonic, on mud in ponds (Frémy, 1930, p. 220).

Distribution: Europe, Equatorial Africa (Frémy, 1930, p. 220); *Antilles and adjacent regions*: Bonaire (44b).

Oscillatoria amphibia Ag. ex Gom. (16, 1892, p. 221).

Ecology: stagnant and slowly streaming, also brackish and thermal waters, lakes, rivers, creeks, alkaline lake, rock-pool, thermal spring with high salinity, 50–60° C, pH 7.5–8 (Frémy, 1930, p. 213; 1941, p. 144; Bourrelly & Manguin, 1952, p. 159; Brannon, p. 76).

Distribution: cosmopolitan (Frémy, 1930, p. 213); *Antilles and adjacent regions*: St. Eustatius (505); Curaçao (Frémy, 1941, p. 144); Guadeloupe (Bourrelly & Manguin, p. 159); St. Croix (Frémy, 1939, p. 32); Florida (Brannon, p. 76).

Oscillatoria okenii Ag. ex Gom. (16, 1892, p. 232) — *fig. 76–77*.

Ecology: cold and thermal waters, cascade, thermal spring with a high salinity, dripping slope, 50–60° C, pH 6.5 (Frémy, 1930, p. 227; Bourrelly & Manguin, p. 161).

Distribution: Europe, Africa, Madagascar, N. America (Frémy, 1930, p. 22); *Antilles and adjacent regions*: Venezuela (553), Bonaire (58b), Nevis (502), Bimini (549); Guadeloupe (Bourrelly & Manguin, p. 161).

Oscillatoria splendida Grev. ex Gom. (16, 1892, p. 224).

Ecology: stagnant, also brackish, thermal and polluted waters, creeks, pools, sulphur spring, on moist soil and walls, on submerged stones (Frémy, 1930, p. 222; Geitler, 1932, p. 972; Bourrelly & Manguin, p. 161; Brannon, 76; Nielsen, 1954, p. 363).

Distribution: cosmopolitan (Frémy, 1930, p. 222); *Antilles and adjacent regions*: Curaçao (76 D); Guadeloupe (Bourrelly & Manguin, p. 161); Florida (Brannon, p. 97; Nielsen, 1954, p. 363).

Oscillatoria brevis Kütz. ex Gom. (16, 1892, p. 229).

Ecology: stagnant fresh and brackish waters, on moist walls, sand and mud, beach, intertidal (Frémy, 1930, p. 224; Geitler, 1932, p. 977; Nielsen, 1954, p. 356).

Distribution: cosmopolitan (Frémy, 1930, p. 224); *Antilles and adjacent regions*: Bonaire (384); Barbados (West, p. 292); St. Croix (Frémy, 1939, p. 33); Puerto Rico (Gardner, p. 269); Florida (Nielsen, 1954, p. 356).

Spirulina Turpin ex Gom.

Spirulina subsalsa Oersted ex Gom. (16, 1892, p. 253).

Ecology: stagnant fresh and brackish, also thermal, waters, sea-water, rivers, ditches, thermal spring, peat-moor, lakes of weak brine and of oversalted seawater, on roots of *Rhizophora*, among corals on a tidal flat, 30° C (Frémy, 1930, p. 236; 1941, p. 146; Geitler, 1932, p. 927; Bourrelly & Manguin, p. 164).

Distribution: cosmopolitan (Frémy, 1930, p. 236): *Antilles and adjacent regions*: Aruba (102 A); Aruba, Curaçao, Bonaire (Frémy, 1941, p. 146); Guadeloupe (Bourrelly & Manguin, p. 164); Puerto Rico (Gardner, p. 272); Florida (Nielsen, 1954, p. 367).

Spirulina subtilissima Kütz. ex Gom. (16, 1892, p. 252).

Ecology: stagnant, also thermal, rarely cold, often polluted waters, sulphur spring, rock-pool, weak brine, on stones and dead roots (Frémy, 1930, p. 234; 1941, p. 145; Geitler, 1932, p. 926).

Distribution: cosmopolitan (Frémy, 1930, p. 234); *Antilles and adjacent regions*: Aruba (93b, 102 A), Curaçao (89), Bonaire (379a, 379b, 379c); Aruba, Curaçao, Bonaire, Klein Bonaire (Frémy, 1941, p. 145); Florida (Nielsen, 1954, p. 367).

Spirulina tenerrima Kütz. ex Gom. (16, 1892, p. 252).

Ecology: brackish and marine waters, on moist sand and stones (Frémy, 1930, p. 233; Drouet, 1942, p. 122).

Distribution: Europe, Equatorial Africa, N. America (Frémy, 1930, p. 233); *Antilles and adjacent regions*: Curaçao (389), Barbuda (667); Jamaica (Drouet, 1942, p. 122).

Spirulina major Kütz. ex Gom. (16, 1892, p. 251) — *fig. 78*.

Ecology: stagnant, also brackish and thermal waters, springs, sulphur spring, coral rocks in littoral zone (Frémy, 1930, p. 234; Nielsen, 1954, p. 367; Frémy, 1939, p. 33).

Distribution: cosmopolitan (Frémy, 1930, p. 234); *Antilles and adjacent regions*: Curaçao (89); St. Croix (Frémy, 1939, p. 33); Puerto Rico (Gardner, p. 272); Florida (Nielsen, 1954, p. 367).

Conclusion

In the present collection 76 species have been found, among which 45 cosmopolitan, as a great many of the Cyanophyceae are, and 22 have such an extended distribution that they may be expected to prove to be cosmopolitan too, after a more thorough exploration of the Cyanophycean flora in many so far neglected areas. Among the 9 remaining species, *Hapalosiphon pumilis*, *Scytonema coactile*, *Aulosira implexa*, *Lyngbya allorgei* and *Oscillatoria obtusa* have a tropical, in some cases, as far as known, very restricted distribution. The following species have also more or less restricted areas: *Microcoleus cavanillesii* (Spain), *Schizothrix heufleri* (Tirol, Iceland), *Lyngbya major* (Europe, Algeria) and *Lyngbya taylorii* (N. America, Guatemala).

The following species from this collection have been found growing in fresh (Cl < 100 mg/l) or nearly fresh water only: *Coccochloris peniocyctis*.

Stigonema ocellatum, *Hapalosiphon pumilus*, *Tolypothrix lanata*, *Aulosira implexa*, *Dichothrix orsiniana*, *Schizothrix vaginata*, *Lyngbya allorgei*.

Remarkable is the abundant occurrence of *Lyngbya aestuarii* and in a lesser degree of *Lyngbya martensiana*. Though in extreme cases these two species can easily be distinguished, this is not always so. According to Gomont (p. 129) the diameter of the trichomes of *Lyngbya aestuarii* is 8–24 μ , the cells are $\frac{1}{3}$ – $\frac{1}{6}$ \times as long as the diameter, and the sheaths can be hyaline when young or when immersed to a certain depth. In *Lyngbya martensiana*, according to Gomont (p. 145–146), the diameter of the trichomes is 6–10 μ , the cells are $\frac{1}{2}$ – $\frac{1}{4}$ \times as long as the diameter, and the sheaths are always hyaline. *Lyngbya aestuarii*, though mostly growing in brackish water and even in strong brines, occurs in fresh water too; *Lyngbya martensiana* is chiefly a fresh-water species, though it has been found growing very rarely in marine habitats. In the present collection *Lyngbya aestuarii* was found 26 times in brackish and 5 times in fresh or nearly fresh water, *Lyngbya martensiana* was found growing 11 times in brackish and once in fresh water. The tips of the trichomes are described for *Lyngbya aestuarii* as slightly attenuate-capitate, truncate (Gom., p. 129, Pl. 3, fig. 2), for *Lyngbya martensiana* as rotund (Gom., p. 146, pl. 3, fig. 17). Thus, specimens growing in fresh water, with hyaline sheaths and having trichomes of a diameter of 8–10 μ , and with cells $\frac{1}{3}$ – $\frac{1}{4}$ \times as long as the diameter can only be recognized by the tips of the trichomes. Here, experiments may show whether or not that is a reliable character.

No new taxa have been found in this collection. Also from Frémy's work on Cyanophyceae from the Wagenaar Hummelink collection from the Leeward Antilles (1941, p. 151), though he described one new species and four new formae, a lack of new entities is evident. For his new species, *Aphanothece minor*, was brought to the synonymy of *Coccochloris elabens* (Bréb.) Drouet & Daily (p. 28), and formae, especially those concerning the diameter of the cells and the colour, can hardly be considered of much interest in a group like the Cyanophyceae where so little about the influence of the environments is known.

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NOTES ON THE SPECIES OF *BAZZANIA* (HEPATICAE) MAINLY OF JAVA

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(Issued on I. XII. 1960)

Introduction

Bazziana is a richly developed genus of Hepaticae, as compared to other hepatics represented by large and conspicuous plants of a creeping habit, with incubous leaves and dichotomously branched shoots, which adhere to the substratum by many flagelliform branches, which are provided with reduced leaves and arise from the axils of underleaves.

After the author had collected material of some 20 species in West Java, he attempted to get some knowledge of the whole genus as it occurs in Java, and of the differences from the *Bazzania* flora of other islands in the Malaysian region. This study is presented here as a preliminary one, and as a forerunner to a fuller treatment of the genus for the whole Malaysian region. Some species are still only known from scanty type collections and their status is rather uncertain. A detailed study of the sexual branches, the perianths and involucra is not attempted here, because the available material is still very incomplete in this respect.

Species of *Bazzania* are especially frequent in moist primary forests from the lowland up into the foggy zone in the mountains, the so-called mossy forests, where they are especially abundant on tree branches. Some species prefer the acid substrate of decaying wood or the forest soil, especially in more open forest with poor sandy soil or on moist sandstone rocks. The last-named substrata are not rare in the East Borneo region visited by the author. In Java he did not notice them.

That the evergreen rain forest with a long wet season is the favourite habitat for most species of *Bazzania* is illustrated by the fact that all 25 species of this genus known from Java have been found in West Java, of which 22 alone on the volcanoes Salak and Gede-Pangrango i.e. in the wettest parts of the island, and three also in the much drier Central and East Java. Though Central and East Java have far lower collection densities in comparison to West Java it is very probable that there exists a definite correlation between a wet climate as is found in moist mountain forests, especially mossy forest and the frequency of species of *Bazzania*.

The centre of the genus seems to lie in the Malaysian region. For S.E. Asia and Oceania the total number of species may be somewhere

between 100 and 150. From South and Central America 72 taxa are recognized in the revision by Fulford (The genus *Bazzania* in Central and South America, Waltham, 1946). From Africa about 30 species were described.

Within the Malaysian region the species are rather irregularly distributed. Of the 25 species occurring in West Java 23 are also found in Sumatra, 16 also in Borneo, 14 also both in Sumatra and Borneo and several also in the Moluccas. From Borneo about 30 species are known. Several species occurring there in the lower regions are not known from Java. From Sumatra I could record 38 species of *Bazziana*. Species occurring there and not known from Java are: *B. conophylla*, *B. acutifolia*, *B. diminuta*, *B. everetti*, *B. recurva*, *B. horridula*, *B. patentistipula*, *B. wiltensii*, *B. renistipula*, *B. fuscescens*, *B. sumatrana*, *B. subserrulata*, and *B. harpago*.

The Moluccas and New Guinea seem to be most different in their *Bazziana* flora. These regions are, however, up till the present insufficiently explored regarding their bryo-flora. Preliminary studies of the genus were made by the author during his stay in the Herbarium Bogoriense, where the then keeper, Prof. Dr M. A. Donk, gave support for carrying on fieldwork in Java and Borneo; later on this study was continued during the winter of 1954/55 at Amsterdam (Hugo de Vries Laboratory).

Thanks are due to the following institutes and persons for their help in various ways: Prof. Dr J. Heimans (Hugo de Vries Lab., Amsterdam), Prof. Dr H. J. Lam (Rijksherbarium, Leiden), Prof. Dr Ch. Baehni and Dr C. E. B. Bonner (Conservatoire de Botanique, Geneva), Dr J. Taylor, the late Dr A. Alston and Mr A. H. Norkett (British Museum, Nat. History, London), Dr H. Persson (Naturhistoriska Riksmuseum, Stockholm), Prof. Dr R. van der Wijk and Mr W. D. Margadant (Botanisch Laboratorium, Groningen).

Subdivision of the genus

Several attempts have been made to subdivide the genus *Bazzania* into sections. The first system was that given by Stephani (Hedwigia 25, 1886, 244) and emended in his Species Hepaticarum (Bull. Herb. Boissier II, 8, 1908, 683). This system has been modified by Fulford (loc. cit.).

The present author tried to arrange the Malaysian species into groups after he had studied their form and variation and afterwards made a study of the older systems. A comparison of his own system with those of Stephani and Fulford is here given. (Table p. 369.)

- 1) This system was also followed by Fulford in her recent paper about *Bazzania* in Central and South America (Bull. Torrey Bot. Club 86: 308—341, 1959).
- 2) The section *Connata* of Stephani's older classification (1886, loc. cit.) has been revived here so as to include all species in which the underleaves are connate with one or both leaves. All American species of his section *Serrulata* as well as one species from his section *Grandistipula* belong here. As far as Malaysian species are concerned it seems better not to maintain the section *Connatae* but to follow Stephani's system (1908) in which he considered species with connation between leaves and amphigastria as members of his sections *Serrulata* and *Grandistipula*. The two latter sections are natural groups as far as Malaysian species are concerned.

Comparison of systems used to divide *Bazzania* into Sections

Fulford 1946 American species ¹⁾	Stephani 1908 World monograph	Most natural division for Malaysian species ⁵⁾ into sections only
A. Not in America	A. Subgenus <i>Integri-</i> <i>folia</i>	VII <i>Integrifoliae</i>
B. Subgenus <i>Bidentatae</i>	B. Subgenus <i>Bidentata</i>	I <i>Bidentatae</i>
C. Subgenus <i>Tridentatae</i>	C. Subgenus <i>Tridentata</i>	
Sections:	Sections:	II <i>Minutae</i> , <i>Section nova</i>
1. <i>Grandistipulae</i>	1. <i>Parvistipula</i> ³⁾	IV <i>Grandistipulae</i>
2. <i>Connatae</i> ²⁾	2. <i>Grandistipula</i>	V <i>Serrulatae</i>
4. <i>Appendiculatae</i>	3. <i>Serrulata</i>	VI <i>Fissistipulae</i>
3. <i>Fissistipulae</i>	4. <i>Appendiculata</i>	
5. <i>Vittatae</i>	5. <i>Fissistipula</i>	
	6. <i>Cordistipula</i> ⁴⁾	III <i>Vittatae</i>

- 3) This section was considered artificial by Fulford (1946) and the species were included in the section *Grandistipulae*. This seems a wise measure also regarding Malaysian species.
- 4) This section has also been discarded by Fulford (1946) as being artificial and the species were included in sections *Grandistipulae* and *Appendiculatae*. All Malaysian species belong to the section *Grandistipulae* as defined in the present revision.
- 5) The Roman numbers indicate the sequence in which the sections are treated in this revision. A distinction between subgenera is dropped because the group *Integrifoliae* is considered strongly related to the *Serrulatae* and the supposed gap between *Bidentata* and *Tridentata* of Stephani and Fulford appears to be bridged by the new section *Minutae*. The whole genus deserves to be divided into series of sections rather than into subgenera.

Key to the sections

- 1a. All leaves with two lobes I. *Bidentatae*
 b. Leaves with two or three lobes or entire 2
 2a. Leaves with distinct vittae 3
 b. Leaves without distinct vittae 4
 3a. Leaves with verrucose cuticle, entire or with indistinct lobes, amphigastria entire
 III. *Vittatae*
 b. Leaves with smooth cuticle, sharply lobed as are the amphigastria II. *Minutae*
 4a. Leaves generally without lobes, margins serrulate VII. *Integrifoliae*

- b. Leaves generally with three (sometimes indistinct) lobes 5
- 5a. Leaf lobes toothed, cells with distinct bulging trigones VI. *Serrulatae*
- b. Leaf lobes generally not toothed or if toothed leaf cells with smaller trigones (cf *B. intermedia*) V. *Fissistipulae*
- 6a. Amphigastria longer than broad or as broad as long, generally lobed; leaf cells with bulging trigones V. *Fissistipulae*
- b. Amphigastria entire or only slightly lobed, broader than long or as long as broad, leaf cells with small trigones or with slightly bulging trigones, in the last case amphigastria more or less reniform IV. *Grandistipulae*

I. BIDENTATAE

This section is characterized by species with only 2-lobed leaves. It is possible, however, that in this way plants of different affinities are taken together. Some species make somewhat the impression to belong to other sections. A final revision, however, of this section cannot be given on the basis of Malaysian material only.

1. *Bazzania fallax* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 158 — *Mastigobryum fallax* Lac., Ann. Mus. bot. Lugd. Bot. 1, 1864, 304 — *Mastigobryum borneense* De Not., Mem. R. Acad. Sc. Torino 28, 1874, 39, pl. 31.

Plants of small dimensions, characterized by their dark brown colour, the two-lobed leaves, relatively big amphigastria and distinct trigones in their cell structure. It is not impossible that this is the same as *B. uncigera* var. *fallax* Lac. ms., leg. Korthals, Sumatra (L). More material of this and other species will probably reveal whether or not this species belongs somewhere in the vicinity of *B. uncigera* of the section *Fissistipulae*.

Distr.: Java, Borneo, Banka.

JAVA. Without exact locality: *Korthals s.n.*, *lectotype* (L).

BORNEO. Mt. Sakumbang: *Korthals* (L).

BANKA. Mt. Maras: v. *Diest* (L).

2. *Bazzania wiltensii* (Steph.) Schiffn., Consp. Hep. Arch. Ind. 1898, 180 — *Mastigobryum wiltensii* Steph., Hedwigia 25, 1886, 237.

Plants of delicate structure, leaves oblong acuminate into two small lobes with faint vittae, amphigastria as broad as the stem, about two times broader than long, apex faintly bilobed.

SUMATRA. West Coast: *Wiltens* (L, *isotype*); Mt. Singgalang, mossy forest near summit: *Meijer* 6278 (L).

II. MINUTAE, nova sectio

Plantae minutae, foliis trilobulatis vel bidentatis, vittatis, amphigastria lobulis acutis.

The plants belonging to this section have many characters in common with members of the section *Bidentatae* but they cannot be included in that section because the leaves often have three lobes. As they cannot be placed in other sections either it seems justified to create for them a

separate one. This section forms a gradual transition between Stephani's subgenera *Bidentata* and *Tridentata*.

3. *Bazzania subtilis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 174 — *Mastigobryum subtile* Lac., Ann. Mus. bot. Lugd. Bat. 1, 1864, 302, pl. 7.

Characterized by two- or three-lobed leaves, bearing a vitta, cells with small trigones and sharply lobed amphigastria. In Java it seems to be a rare species. Closely related is a species which also belongs to this section: *Bazzania remotifolia* Herz., Trans. Br. Bryol. Soc. 1, 1950, 304 non *B. remotifolia* Horikawa, Journ. Sc. Hir. Un. (Bot.) 2, 1934, 193. I propose for that species the new name *B. herzogiana* Meijer, nom. nov. It resembles *B. wiltensii* from Sumatra as to its dimensions and possession of vittae. *B. wiltensii*, however, is a member of the section *Bidentatae*, also differing in its amphigastria which are short and entire.

Distr.: Java, Sumatra, Borneo. As to the specimen from Amboina, comm. Luerssen, it is doubtful whether it belongs to this species.

JAVA. West Java, Mt. Pangrango near Tugu, along a road, 1100 m alt.: Meijer 3324a (BO).

SUMATRA. Without exact locality: Korthals s.n., lectotype (L) — West coast, Lubuk Sikaping, Mt. Gadang: Van Borssum Waalkes 2015b (BO).

BORNEO. Serawak, Mt. Mattang, Beccari 1866 (L).

III. VITTATAE

Characterized by blunt to three-lobed leaves which bear distinct vittae. Owing to the minutely verruculose cuticle they have a blue-green appearance. Hyaline amphigastria.

4. *Bazzania vittata* (Gott.) Trev., Mem. Ist. Lomb. 13, 1877, 414: Evans, Pap. Mich. Ac. Sc. 17, 1933, 111 — *Mastigobryum vittatum* Gott., in Syn. Hep. 1845, 216; Lindenberg & Gottsche, Spec. Hep. Monogr. Mastigobryum, 1851, 6, pl. 2.

The only species of this section in Java. It is a very common species and easy to recognize by its vittae and its blue appearance. The apices of the leaves are variably truncate with three short teeth or rounded, retuse or subentire. *B. luzonensis* (Steph.) should be another species of this section, according to Evans (Pap. Mich. Ac. Sc. 17, 1933, 113), the plants being larger, the ventral branches more frequently flagelliform and the leaves narrower and more often three-toothed than in *B. vittata*. Another species belonging to this section is *Bazzania flavescens* (St.) Schiffn., Consp. Hep. Arch. Ind. 1898, 158. (*Mastigobryum flavescens* St., Hedwigia 25, 1886, 6, pl. 3, fig. 1—3) from Celebes. It bears the same verruculose cuticle, giving it a blue colour and it possesses the same hyaline amphigastria and vittae as *B. vittata*. Differences are found in the fact that not only the leaves but also the amphigastria are verrucose and in the more distinctly lobed leaves. It is rather astonishing that Stephani afterwards (Sp. Hep. 3, 1909, 341) placed this species in the genus *Mastigopelma*, in which it differs widely from the type species, *M. simplex* Mitten, represented among others in the Geneva herbarium.

Ecology: in primary forests, in Java known from 1200—2700 m.
Distr.: Java, Sumatra, Philippines.

JAVA. Without exact locality: Zollinger, *Korthals*, *Junghuhn* (L) — West Java, Bogor: *Kurz HB 3760* (BO); Mt. Pamabula pr. Tugu: *Kurz* (L); Mt. Pangrango: *De Vriese* (L); Tjibodas region to Kandang Badak, numerous coll.: *Verdoorn*, *Neervoort* and *Meijer* (BO); Mt. Gede above Sukabumi: *Verdoorn 1636*; Mt. Tangkuban Prah: *Verdoorn 1863* (BO); Mt. Papandajan: *Verdoorn 3422, 3426, 4920* (BO); Telaga Bodas: *Korthals* (L), *Verdoorn 1606, 4919* (BO); Mt. Patuhan: *Verdoorn 1652* (BO); Mt. Tjikorai: *Verdoorn 1279* (BO).

SUMATRA. West Coast: *Wiltens* (L); Mt. Sago near Pajakumbuh: *Meijer 6227* (L); Mt. Singgalang: *Meijer 6276* (L), also reported by Evans l.c.

PHILIPPINES. Luzon, Mt. Maquilang: *C. B. Robinson, Bur. Sc. 17311* (L).

IV. GRANDISTIPULAE

This section is well represented in Java (9 species). Common characters are: amphigastria entire or only slightly lobed, as well as the leaves without auricles or appendages. Other characters vary: cells with slight trigones only or with distinct trigones (*B. praeurupta*), amphigastria hyaline throughout (*B. tridens*), partly (*B. intermedia*) or not at all, margin recurved or not. Amphigastria slightly cordate (*B. javanica*) to strongly so (*B. praeurupta*), free or more or less connate with lateral leaves (*B. densa*). Leaf margins in most species entire but in one (*B. intermedia*) irregularly serrulate.

Key to the species

- | | |
|---|--------------------------|
| 1a. Amphigastria broader than the stems, irregularly lobed or emarginate, all cells hyaline | 5. <i>B. tridens</i> |
| b. Amphigastria without hyaline cells or with hyaline border only | 2 |
| 2a. Amphigastria with hyaline border, leaf lobes often serrulate | 10. <i>B. intermedia</i> |
| b. Amphigastria without hyaline border | 3 |
| 3a. Apex of older amphigastria patent or (and) reflexed | 4 |
| b. Apex of older amphigastria not patent or reflexed | 7 |
| 4a. Leaves more or less falcate | 5 |
| b. Leaves not falcate or only slightly so | 6 |
| 5a. Leaves slightly falcate, apex with three distinct lobes | 11. <i>B. serpentina</i> |
| b. Leaves strongly falcate, apex blunt, with three indistinct lobes or entire | 7. <i>B. zollingeri</i> |
| 6a. Amphigastria about as broad as long, margin toothed | 9. <i>B. sumbavense</i> |
| b. Amphigastria broader than long, margin entire | 8. <i>B. densa</i> |
| 7a. Amphigastria reniform, two to three times as broad as the stem, leaf lobes different in length, divergent | 12. <i>B. praeurupta</i> |
| b. Amphigastria not more than twice as broad as the stem, not reniform | 8 |
| 8a. Amphigastria emarginate at apex, somewhat broader than the stem, not closely appressed to the stem | 13. <i>B. javanica</i> |
| b. Amphigastria slightly and irregularly lobed at apex, not broader than the stem, somewhat broader than long and closely appressed to the stem | 6. <i>B. pectinata</i> |

5. *Bazzania tridens* (R., Bl., N.) Trev., Mem. Instit. Lomb. 13, 1877, 415; Evans, Pap. Mich. Ac. Sc. 17, 1933, 77, pl. 14, fig. 1—11 — *Jungermannia tridens* R., Bl., N., Nov. Act. 12 (1), 1824, 228 — *Mastigobryum tridens* Nees, Syn. Hep. 1845, 227; Lindenb. et Gott., Sp. Hep. Monogr. Mastigobryi, 1851, 81, pl. 14, fig. 1—5 — *M. ceylanicum* Mitten, J. Linn.

Soc. 5, 1861, 105 (syn. nov.) — *M. olivaceum* Steph., Bull. Herb. Boissier II. 8, 1908, 757 (syn. nov.) — *M. tjibeurum* Steph., Sp. Hep. 6, 1924, 483 — *M. typicum* Steph., Sp. Hep. 6, 1924, 484.

Plants characterized by their distinct, sharply lobed, slightly or not falcate leaves with slightly prominent vittae. Amphigastria hyaline, cell walls thin or fairly thickened, quadrate, somewhat broader than or as broad as the stem, oil bodies 3—5 in each cell. Variation is found in dimensions and width of amphigastria. Ventral leaf basis more or less rounded. In other islands this species has closely related forms. The present author noticed several of these, especially in his Borneo collections. They differ for example by shorter, more blunt leaves and by amphigastria which are in their lower half not hyaline. It will not always be easy to make a sharp distinction between the different forms. The most constant character of *B. tridens* is the structure of the cell net in its leaves. Small quadrate cells border the indistinct vitta along the dorsal and ventral leaf margin and they are bigger, rather elongate with small trigones, at the apex. The vitta is laying more at the ventral than at the dorsal side of the leaf.

Ecology: On decaying wood or forest soil in primary forest, in Java from 1000—2500 m.

Distr.: Java, Sumatra, Borneo, Moluccas.

JAVA. Without exact locality: *Horsfield* (BM), *Korthals* (L), *Kurz HB 3763* (BO) — West Java. Without exact locality: *Teysmann* (L); *Tji Anten*, *Leuwiliang*: *Meijer 1117, 1131* (BO); *Salak*: *Kurz* (L); *Puntjak*, *Telaga Warna*: *Luiking & Butot* (GRON); *Mt. Gede*, *Tjijbodas-Tjibeureum*: *Verdoorn, Meijer, Neervoort*, numerous coll. (BO); *Mt. Pangrango*: *Meijer, Neervoort*, numerous coll. (BO); *Gegerbintang ridge*: *Kurz, s.n.* (L), *ibidem*: *Meijer, Neervoort*, numerous coll. (BO); *Mt. Tangkuban Prah*: *Verdoorn 3482, 3489* (BO); *crater Tjiwidei*, without coll. (L); *Mt. Tilu*: *Verdoorn 1981* (BO); *Mt. Malabar*: *Verdoorn 1929* (BO); *Mt. Papandajan*: *Verdoorn 3414, 3425* (BO); *Telaga Bodas*: *Verdoorn 1609, 1893* (BO); *Tjikorai*: *Verdoorn 1245, 1253* (BO) — Central Java, *Mt. Lawu*: *Verdoorn 128, 1501* (BO) — East Java, *Mt. Kawi*: *Verdoorn 1067* (BO); *Mt. Pandansari*: *Verdoorn 1013* (BO); *Mt. Tengger*: *Verdoorn 1737* (BO); *Mt. Wilis*: *Clason* (GRON).

SUMATRA. Without exact locality: *Teysmann* (L); expedition 1878 (L) West Coast, *Padang*: *Wiltens* (L); *Mt. Sago*: *Meijer 6265, 6266, 6267* etc. (L); *Mt. Korinchi*: *Meijer 7820*, *Lubuk Sikaping*, *Mt. Gadang*: *Van Borssum Waalkes 2005, 2014, 2015e* — *Mentawai Islands*, *Siberut*, *Van Borssum Waalkes 2715* (BO) — East coast, *Prapat*, *Van der Wijk 1833* (GRON).

BANKA: *Kurz* (L).

CERAM: *De Vriese* (L).

6. *Bazzania pectinata* (Lindenb. et Gottsche) Schiffn., Nov. Act. 60. 1893, 259, pl. 16, fig. 11; *Evans*, Pap. Mich. Ac. Sc. 17, 1933, 81, pl. 14, fig. 12—19 — *Jungermannia tridens* var. β *Nees*, Hep. Jav. 1830, 61 — *Mastigobryum tridens* var. β *Gottsche*, *Lindenb. et Nees*, Syn. Hep. 1845. 227 — *Mastigobryum pectinatum* *Lindenb. et Gottsche*, Spec. Hep. Monogr. *Mastigobryi*, 1851, 84. pl. 14, fig. 6—10.

Characterized by its more or less falcate leaves, frequently bluntly lobed, amphigastria not hyaline, narrower than the stem, broader than long in outline, irregularly retuse and appressed to the stem. This species is easily distinguished from *B. tridens* by the structure of its amphigastria and by the more falcate leaves. It seems to be closely related to *B. densa* which differs by its recurved upper margin of the amphigastria.

Ecology: in mountain forest 1000—2000 m, on bark.

Distr.: Java, Sumatra, Borneo.

JAVA. Without exact locality: *Blume* (isotype?), *Junghuhn*, *Teysmann*, *Korthals* (L) — West Java. Without further locality: *Zippelius*, *Treub*, *Teysmann* (L); Tji Anten, Leuwiliang: *Meijer* 1112, 1192 (BO); Mt. Megamendung: *Verdoorn* 3097 (BO); Tjibodas: *Nymann* (L); Tjibodas-Tjibeureum: *Verdoorn*, *Neervoort*, *Meijer*, numerous collections (BO); Mt. Pangrango: *Meijer* 299a, 756, 765 (BO); Mt. Gegerbintang: *Meijer* 466, 471b, ibidem: *Neervoort* 1702, 2325 (BO); Lembang: *Korthals* (L); Tangkuban Prah: *Meijer* 3519 (BO); Mt. Patuha: *Verdoorn* 3478 (BO); Mt. Malabar: *Verdoorn* 954 (BO).

SUMATRA. Without exact locality: *Teysmann* (L) — West Coast, Mt. Sago: *Meijer* 6224 (L); Mt. Singgalang: *Meijer* 6279, 6283 (L); Mt. Tandikat: *Meijer* 6290 (L); Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 2015d, 2022b, 2025 (BO); Mt. Korinchi: *Meijer* 8736 (L).

BORNEO. Without exact locality: *Korthals* (L).

7. *Bazzania zollingeri* (Lindenb.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Mastigobryum zollingeri* Lindenb. in Meissn., Bot. Zeit. 6, 1848, 462; Lacoste, Ann. Mus. bot. Lugd. Bat. 1, 1864, 302, pl. 8; De Notaris, Mem. Ac. Sc. Torino II. 28, 1874, 35, pl. 16.

Characterized by strongly falcate leaves, almost entire or more distinctly two- or three-lobed, with cells at apex much smaller than at base, trigones small, amphigastria hyaline, broader than long or as broad as long, about the same width as the stem, short tongue-shaped, at older parts of the stem reflexed at apex.

Distr.: Java, Sumatra.

JAVA. West Java, Salak: *Zollinger* 815z (type L); Tangkuban Prah: *Van der Wijk* (GRON).

SUMATRA. East coast, Brastagi: *Van der Wijk* 1742 (GRON) — West coast, Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 1922 (BO); Taram, Tjajmpo-region about 500 m alt.: *Meijer* 8426 (L).

8. *Bazzania densa* (Lac.) Schiffn., Consp. Hep. Arch. Ind., 1898, 151 — *Mastigobryum densum* Lac., Ned. Kruidk. Arch. 3, 1854, 418, Natuurk. Tijdschr. N. Indië 10, 1856, 395; Syn. Hep. Jav. 1856, 40, pl. 7.

Plants with blunt leaf apex, amphigastria broader than long, upper margin reflexed, slightly broader than the stem. Cells only with small trigones. Somewhat related to *B. pectinata*, which differs in its non-reflexed margin of amphigastria and to *B. zollingeri* which possess stronger falcate and blunter leaves. The variety *connata* Lacoste (Ann. Mus. bot. Lugd. Bat. 1, 1863, 302) has been named *Mastigobryum connatum* Steph. (Hedwigia 24, 1885, 248, pl. 2, fig. 2) and *Bazzania connata* (Steph.) Schiffn., (Consp. Hep. Arch. Ind. 1898, 150); its type comes from Sumatra, leg. Teysmann (L). It seems too early to decide whether this form deserves specific rank as the amphigastria are also at one or both sides connate with the leaves in the type of *B. densa*. Related species are *B. concinnata* De Not. and *B. borneensis* Steph.

Ecology: probably a species of open sunny habitat in Borneo, frequently in so-called padang forests on decaying wood or on acid soil, in Java especially in lower regions (750—1800 m) of the mountains.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Junghuhn*, type (L) — West Java, Tji Anten, Leuwiliang: *Meijer* 1115 (BO); Tangkuban Prah: *Verdoorn* 1870, ibidem: *Meijer* 3507, 3508, 3512 (BO).

SUMATRA. West coast, Mt. Nantigo near Mt. Sago: *Meijer* 6286 (L), Mt. Sago: *Meijer* 6260, 6262, 6710, 6780 (L).

9. *Bazzania sumbavensis* (Steph.) Steph., Eng. Bot. J. 23, 1896, 307 — *Mastigobryum sumbavense* Steph., Hedwigia 25, 1886, 236, pl. 2, fig. 13—15.

Plants somewhat smaller than in *B. tridens*. Leaves lingulate, margins almost parallel, apex bluntly lobed, amphigastria broader than the stem, somewhat broader than long, rectangular, irregular lobed at occasionally recurved apex. Leaf cells with small trigones. According to Stephani (loc. cit.) this species should be distributed from Nepal to Samoa. It seems rather closely related to *Bazzania patentistipa* (Lac.) Schiffn. from Borneo and Sumatra but the latter is more restricted to lowland regions. *Bazzania conophylla* (Lac.) Schiffn. from Banka and recently detected by me in Sumatra is also related to this species but its amphigastria are about as narrow as the stem and the leaf cells possess bulging trigones.

Distr.: Java, Sumatra.

JAVA. Without exact locality, herb. Lacoste (L) — West Java, Mt. Gede: *Verdoorn* 2105, 2836; ibidem: *Meijer* 4189, 4190; ibidem: *Bouman s.n.* (GRON 3498); Pangrango: *Neervoort* 421; Papandajan: *Verdoorn* 3448 (BO); Idjen Plateau: *Clason* (GRON 3433).

SUMATRA. West coast, Mt. Merapi: *Meijer* 6296 (L); ibidem: *Van Borssum Waalkes* 2248a (BO).

10. *Bazzania intermedia* (Lindenb. et Gottsche) Trev., Mem. Ist. Lomb. 13, 1877, 415; Evans, Pap. Mich. Ac. Sc. 17, 1933, 89, pl. 15; fig. 16—25. — *Mastigobryum intermedium* Lindenb. et Gottsche, Spec. Hep. Monogr. Mastigobryi, 1851, 82, pl. 12. — *Mastigobryum concinnum* De Not., Mem. Real. Ac. Sc. Torino II. 28, 1874, 33, pl. 25. — *Bazzania concinna* (De Not.) Trev., Mem. Ist. Lomb. 13, 1877, 415.

Differing from *B. tridens* by the irregularly serrulate, but sometimes almost entire leaf apex and the distinct band of chlorophyll cells in the lower half of the amphigastria. In addition, the trigones in the leaf cells are more prominent. This species comes near the members of the section *Serrulatae*. It is, however, so strongly linked with the section *Grandistipulae* that it cannot be removed from that section. Some forms with almost entire leaves and a small band of chlorophyll cells in the amphigastria are difficult to separate from *B. tridens*.

Ecology: probably a lowland species which is now very rare or absent in Java.

Distr.: Java, Sumatra, Banka, Borneo.

JAVA. Without exact locality: *Kuhl et v. Hasselt, Teysmann* (L) — West Java, Salak: *Kurz* (L).

SUMATRA. Without exact locality: *Korthals* (L), also mentioned by Evans (loc. cit.) from that island. — West coast, Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 2013, 2018 (BO).

BANKA. *Kurz* (L).

BORNEO. Serawak, Mt. Mattang: *Beccari*, isotype of *Mastigobryum concinnum* De Not. (L) — East Borneo, Peak of Balikpapan: *Meijer* 1276, 1284a (BO); Sangkulirang: *Kostermans* HB 6149 (BO).

11. *Bazzania serpentina* (Nees) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Bazzania serpentina* (Nees) Schiffn., Consp. Hep. Arch. Ind. 1898, 173. —

Jungermannia serpentina Nees, Hep. Jav. 1830, 62 — *Mastigobryum serpentinum* (Nees) Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 111, pl. 19.

Leaves short falcate, cells with bulging trigones, more or less orbicular amphigastria with recurved upper margin. The only species with which *B. serpentina* may be confused is *B. praerupta*, but the latter may be distinguished by their less falcate leaves which are longer and more sharply pointed and by the more auriculate amphigastria, with the upper margin generally not reflexed.

Ecology: in mountain forests, above 1000 m.

Distr.: Java, Sumatra, Borneo.

JAVA. Without exact locality: *Junghuhn*, *Teysmann*, *Zippelius* and *Korthals* (L) — West Java, locality unknown: *Hasskarl* (L); Salak: *Kurz* (L); Mt. Pangrango: *de Vriese*, *Kuhl* et *v. Hasselt* (L); Mt. Gede: *Verdoorn* 2126, 2415, 2897 (BO). ibidem: *Neervoort* 2552d (BO); Telaga Bodas: *Korthals* (L).

SUMATRA. West coast, Mt. Singgalang: *Meijer* 6270, 6289 (L).

BORNEO. *Korthals* (L).

12. *Bazzania praerupta* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 414. — *Jungermannia praerupta* Reinw., Bl., N., Nova Act. 12, 1824, 229 — *Mastigobryum praeruptum* (Reinw., Bl., N.) Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1840, 224; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi 1851, 58, pl. 10, fig. 1—7. — *Bazzania sandei* Steph., Hedwigia 25, 1886, 206, pl. 3, fig. 39—43.

Plants distinct by their orbicular amphigastria, cell walls with bulging trigones and sharp, more or less divergent leaf lobes. For differences with *B. serpentina* see under that species. Living material from Sumatra showed oil bodies, round to oblong, 5—8 in each cell.

Ecology: from 1700—2500 m in primary forest on tree branches.

Distr.: Java, Sumatra, Borneo, Moluccas.

JAVA. Without exact locality: *Teysmann*, *Junghuhn*, *Korthals* (L) — West Java, Salak: *Kurz* (L); Pangrango: *Kuhl* et *v. Hasselt*, *De Vriese* (L); ibidem: *Neervoort* 509 (BO); ibidem: *Meijer* 754 (BO); Mt. Gede about 2000—3000 m: *Verdoorn* 1135, 1141, 2105, 2836; ibidem: *Meijer* 3018, 3998, 4006, 4120 (BO); ibidem: *Neervoort* 2522, 2545 (BO); ibidem: *Bouman* (GRON 3481); Tangkuban Prah: *Korthals* (L); Telaga Bodas: *Korthals* (L); Papandajan: *Korthals* (L); Mt. Patuha: *Verdoorn* 700, 703, 705 (BO).

SUMATRA. Without exact locality: *Korthals* (L), *André Wiltens*, type of *Bazzania sandei* Steph. (L) — West coast, Mt. Sago: *Meijer* 6229, 6316a (L); Mt. Singgalang: *Meijer* 6282, 7255a, 7257, 7389a, 8130a (L).

BORNEO. Without exact locality: *Korthals* (L).

CERAM: *de Vriese* (L).

13. *Bazzania javanica* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 163 — *Mastigobryum javanicum* Lac., Ned. Kruidk. Arch. 3, 1854, 418; Syn. Hep. Jav. 1856, 42, pl. 8.

Much resembling minute forms of *B. praerupta* but leaves and amphigastria more distant; leaves partly 2-lobed, amphigastria not or scarcely auricled.

Ecology: from 1700—2000 m in primary forest.

Distr.: Java, Sumatra, Moluccas.

JAVA. Without exact locality: *Junghuhn*, type (L) — West Java, Mt.

Salak: Kurz (L); Mt. Pangrango: Meijer 818 pp. (BO); Mt. Malabar: Verdoorn HB 998 (BO).

SUMATRA. West coast, Padang: André Wiltens (L); Mt. Sago: Meijer 6235 (L). CERAM: De Vriese (L).

V. FISSISTIPULAE

The principal characters of this section are: big amphigastria of firm texture, either entire or slightly or strongly lobed or (and) auricled, ventral leaf basis slightly or greatly widened, cells in most cases of a firm structure, with bulging trigones, leaf lobes acute, entire or only slightly serrulate.

Key to the species

- 1a. Amphigastria orbicular to quadrangulate with reflexed entire margin; leaves with ventral appendage narrowed towards the apex three lobed, sometimes with dentate lobes 20. **B. commutata**
- b. Leaves and amphigastria of another structure 2
- 2a. Dorsal leaf basis with dentate lobe, amphigastria with many sharp lobes 18. **B. calcarata**
- b. Dorsal leaf basis without dentate lobe 3
- 3a. Leaves narrow, somewhat falcate, at the base three to five times as broad as near the apex, amphigastria rectangular, irregularly lobed at the lateral margins, upper half often reflexed 14. **B. uncigera**
- b. Leaves broader, less falcate 4
- 4a. Amphigastria longer than broad, lateral margin entire or slightly lobed, apex irregularly dentate or lobed, base auricled 19. **B. linguaeformis**
- b. Amphigastria as broad as long or broader than long 5
- 5a. Lateral margins of amphigastria generally with big lobes 6
- b. Amphigastria more or less quadrate, margins only slightly lobed and dentate 15. **B. uncigera** var. **gibba**
- 6a. Well-developed amphigastria, broader than long, almost entire or short-lobed at the lateral margins, at their apex with 4—5 lobes, basis shortly auriculate 16. **B. gedeanana**
- b. Well-developed amphigastria about as long as broad, along whole margin sharply lobed, often with big primary lobe and smaller secondary lobes, basis with big auriculae, the length of which is $\frac{1}{8}$ — $\frac{1}{4}$ of total length of the amphigastria 17. **B. paradoxa**
- c. Amphigastria quadrangulate, as long as broad or longer than broad, lobed along the margin, less distinctly auriculate, plants more robust than any other species of this section (not mentioned further in this paper) **B. sumatrana** (Lac. in Steph.) Schiffn.

14. *Bazzania uncigera* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Jungermannia uncigera* Reinw., Bl., Nees, Nov. Act. 12, 1824, 230 — *Mastigobryum uncigerum* (Reinw., Bl., N.) Lindenb., in Gottsche, Lindenberg et Nees, Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 112, pl. 19, fig. 6—10.

Rather small plants, characterized by 2—3 lobed narrow leaves and rectangular amphigastria, longer than broad, with irregularly lobed margins. Amphigastria especially on younger branches, at base concavely bulging and the apex slightly recurved.

Ecology: between 1300 and 2000 m on stems and branches of trees in mossy forest.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Teysmann* (L) — West Java, Mt. Salak: *Kurz* (L); Mt. Gede: *Zippelius* (L); ibidem: *Meijer* 4164b (BO); Tjibodas, Mt. Garden: *Van der Wijk* 1103 (GRON); Tjibodas-Tjibeureum: *Verdoorn* 2024, ibidem: *Meijer* 3474 (BO); Mt. Pangrango: *Meijer* 777b, 868, 908a, 3358 (BO); Gegerbintang: *Meijer* 932b, *Neervoort* 1196 (BO) — East Java, Dorowatti: *Clason* (GRON 3414).
 SUMATRA. West coast, Expedition 1878, a variety with greater and broader leaves (L); Pajakumbuh, Mt. Sago: *Meijer* 6220, 6221 etc. (L); Mt. Tandikat: *Meijer* 6292 (L); Mt. Korinchi: *Meijer* 7597, 7668, 7713, 7715 (L) — East coast, Brastagi: *Van der Wijk* 1651, 1691 (GRON).

15. *Bazzania uncigera* var. *gibba* (Lac.) Meijer, var. nov. — *Bazziana gibba* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 959 — *Mastigobryum gibbum* Lac., in Dozy, Ned. Kruidk. Arch. 4, 1855, 94; Lac., Syn. Hep. Jav. 1856, 45, pl. 9.

Plants resembling *B. uncigera*, but leaves relatively broader and more bluntly lobed, at ventral base auricled, amphigastria about as broad as long, bulging at base, margin with irregular blunt teeth, at apex somewhat reflexed. Leaf cells strongly incrassate. Rarely collected. Differs from *B. everetti* St. from Borneo and Sumatra by its relatively longer amphigastria, which are bulging at base and the brown colour of the cell walls.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Junghuhn*, type (L) — West Java: *Teysmann* (L).

SUMATRA. West coast: *André Wiltens* (L); Mt. Korinchi: *Meijer* 7687, 7699 (L); Mt. Sago: *Meijer* 6868, 8235c (L).

16. *Bazzania gedeana* (Steph.) Meijer, comb. nov. — *Mastigobryum gedeanum* Steph., Sp. Hep. 3, 1909, 540; Sp. Hep. 6, 1924, 463 — *Mastigobryum fleischeri* Steph., Bull. Herb. Boissier II. 8, 1908, 945; Sp. Hep. 3, 1908, 495, non *M. fleischeri* Steph., Bull. Herb. Boissier II. 8, 1908, 773; Sp. Hep. 3, 1908, 457 — *Mastigobryum uncigera* var. *Nees*, Hep. Jav. 1830, 61; Gottsche, Lindenb. et Nees., Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 112, pl. 19, fig. 6—10.

Plants with rather broad and relatively short leaves, not much narrowed towards apex, amphigastria broader than long, with 4—6 lobes at apex and slightly or not lobed at lateral margin, not or only slightly auricled at base. Among Stephani's Icones a drawing was found of a specimen collected by Fleischer on Mt. Gede, probably the type of *B. gedeana*; I could not find this in Stephani's herbarium where it was indicated as lacking: "manque". Almost identical with this species is *Mastigobryum everetti* Steph. from Borneo and the Philippines. *Mastigobryum malaccense* St. should be compared with this species.

Ecology: Mt. forests above 1000 m altitude, bark epiphyte.

Distr.: Sumatra, Java, Philippines.

JAVA. Without exact locality: *Teysmann*, *Junghuhn* (L) — West Java; Mt. Salak: *Kurz* (L); Mt. Gede: *Fleischer*, figured in *Icones Stephani*; Tjibodas: *Verdoorn* 2497; ibidem: *Meijer* 205 (BO); Pangrango: *Meijer* 335b, 867, 3360 (BO) — Central Java, Mt. Lawu: *Verdoorn* 826 (BO) — East Java, Mt. Slamet: *Verdoorn* 1564 (BO).

SUMATRA. West coast, Mt. Sago: *Meijer* 6749 (L).

PHILIPPINES. Polillo prope Luzon: *MacGregor*, Bur. of Sc. 10502 (G).

17. *Bazzania paradoxa* (Lac.) Steph., Engl. Bot. Jahrb. 23, 1896, 307 — *Bazzania paradoxa* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898,

168; Evans, Pap. Mich. Ac. Sc. 17, 1933, 102, pl. 18, fig. 1—11 — *Mastigobryum paradoxum* Lac., Ned. Kruidk. Arch. 3, 1854, 419; Syn. Hep. Jav. 1856, 46, pl. 9.

Big plants characterized by strongly auricled amphigastria, in adult state margin divided into about 10 primary lobes which are provided with secondary incisions. Sometimes only primary lobes well developed. Leaf lobes sharp, mostly of different length. One of the most characteristic species of Java. Only to be confused with *B. gedeana*, when young branches are compared.

Ecology: between 1200—1630 m in Java.

Distr.: Malaya, Sumatra, Java, Borneo.

JAVA. Without exact locality: Gesker (L) — West Java: *Teysmann* (L); Mt. Salak: *Zollinger* (L); Mt. Gede: *Zippelius* (L); Mt. Pangrango: *Meijer 3337* (BO); Gegerbintang: *Neervoort 1050* (BO).

SUMATRA. West coast: *André Wiltens* (L); ibidem: *Teysmann* (L); ibidem: expedition 1878 (L); also reported by Evans (loc. cit.) from Sumatra; Pajakumbuh, Mt. Sago: *Meijer 6221a, 6222, 6259, 8267* (L); Mt. Tandikat: *Meijer 6204, 8096* (L); Mt. Singgalang: *Meijer 6275a* (L) — East coast, Brastagi: *Van der Wijk 1615* (GRON).

MALAYA. Pahang: *Henderson 1* (GRON).

BORNEO. East Borneo, Peak of Balikpapan: *Meijer 1831* (BO).

18. *Bazzania calcarata* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1848, 149 — *Mastigobryum calcaratum* Lac., Ann. Mus. bot. Lugd. Bat. 1, 1864, pl. 8, 304.

Delicate plants with sharp, often divergent, pointed leaf lobes, densely armed amphigastria and a very peculiar toothed auricle at the ventral leaf base. This species seems to be very rare in Java. It is closely related to *B. lancifolia* St. from Celebes. *Bazzania richardsii* Herzog., Trans. Br. Bryol. Soc. I, 1950, 302, probably belongs to this species.

Distr.: Malaya, Sumatra, Java, Borneo.

JAVA. Without exact locality: *Zippelius, lectotype* (L).

SUMATRA. West coast: expedition 1878 (L); Mt. Gadang near Lubuk Sika-ping: *Van Borssum Waalkes 20115a* (BO); Mt. Korinchi, 1600—2000 m: *Meijer 8691* (L); Taram, Tjampo region: *Meijer 8432* (L).

MALAYA. Pahang: *Henderson 37* (GRON).

BORNEO. South Borneo, Mt. Sakumbang: *Korthals* (L) — East Borneo, Peak of Balikpapan, Sulau Mandau terrace: *Meijer* (BO).

19. *Bazzania linguaeformis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 164 — *Mastigobryum linguaeforme* Lac., Ned. Kruidk. Arch. 4, 1855, 94; Syn. Hep. Jav. 1856, 41, tab. 8.

Rather robust plants. Leaves oval-oblong from a broad dorsal rounded base narrowed towards the apex, ventral leaf base slightly auricled. Leaf cells with big bulging trigones. Amphigastria generally longer than broad, auricled at their base, slightly lobed and with recurved margin et apex.

Distr.: Sumatra, Java.

JAVA. Without exact locality, herb. *Dozy & Molkenboer, type* (L) — West Java, Gegerbintang ridge, 1700—1750 m: *Meijer 499* (BO).

SUMATRA. West coast: *André Wiltens* (L); Pajakumbuh, Mt. Sago: *Meijer 6248* (L).

20. *Bazzania commutata* (Lindenb. et Gott.) Schiffn., Consp. Hep. Arch. Arch. Ind. 1898, 149 — *Mastigobryum commutatum* Lindenb. et Gottsche,

Sp. Hep. Monogr. Mastigobryi, 1851, 97, pl. 22 — *Mastigobryum miquelianum* Lehm., Pugillus 10, 1837, 8 (syn. nov.) — *Bazzania miqueliana* (Lehm.) Schiffn., Consp. Hep. Arch. Ind. 1898, 167.

Plants with very broad leaf bases, leaves oval with a broad base, narrowed towards an irregular lobed or toothed apex. Ventral leaf base occasionally with small appendages. Amphigastria imbricate, almost quadrate, with short rounded auricles, margin reflexed. Cells in leaves and amphigastria with bulging trigones. This species resembles *B. indica* in its type of amphigastria and *B. spiralis* in the serrulation of its leaf lobes, a character which is, however, not always well pronounced.

Distr.: Java.

JAVA. Without exact locality and collector (L); ibidem: comm. Miquel, type of *B. miqueliana* (S-PA) — West Java: *Teymann* (L); Tji Anten, Leuwiliang: *Meijer 3461* (BO); Gegerbintang ridge: *Neervoort 2028, 3076* (BO); Mt. Gede, Tjibodas, between Mt. Garden and Tjibeureum: *Verdoorn 2518* (BO).

VI. SERRULATAE

This section comprises a group of closely related species, all of which have in common the serrulate leaf margins.

Key to the species

- 1a. Amphigastria without hyaline border 2
- b. Amphigastria with hyaline border 4
- 2a. Amphigastria about as long as broad, margin flat and irregularly serrulate 21. *B. longicaulis*
- b. Margin of amphigastria reflexed, leaves more or less falcate 3
- 3a. Leaves lingulate, apex of amphigastria entire 24. *B. desciscens*
- b. Leaves shorter, amphigastria serrulate at apex 25. *B. indica*
- 4a. Margins of amphigastria generally imbricate, more or less quadrate, flat 22. *B. erosa*
- b. Amphigastria not imbricate, with recurved margin, broader than long, apex recurved 23. *B. spiralis*

21. *Bazzania longicaulis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 165 — *Mastigobryum longicaule* Lac., Ann. Mus. bot. Lugd. Bat. 3, 1864, 303, pl. 8.

The diagnostic characters of this species are: narrow oblong leaves, amphigastria longer than broad, margin not reflexed, without hyaline band, sharply toothed, in some cases with primary and secondary teeth. There is some variation in the dentation of leaves and amphigastria. A detailed description of this species has been given by Evans (Pap. Mich. Ac. of Sc. and Arts 27, 1933, 93—97, pl. 16) after material from North Sumatra (Karoland), under the name of *B. erosa*. This name is a consequence of a misinterpretation of Stephani's description of that species.

Distr.: Sumatra, Java, Philippines.

JAVA. Without exact locality: *Teymann anno 1858* (L); ibidem: *anno 1859*, type (L) — West Java, Mt. Salak: *Kurz* (L); Mt. Pangrango: *Meijer 755, 759, 766, 770* (BO); Mt. Gegerbintang: *Meijer 460* (BO); Mt. Papandajan: *Verdoorn 1840* (BO).

SUMATRA. West coast, expedition 1878 (L), Padang: *André Wiltens*; Pajakumbuh, Mt. Sago: *Meijer 6219, 6225*, etc. (L); Mt. Singgalang: *Meijer 6284* (L); Mt. Tandikat: *Meijer 6291, 8091, 8100b* (L); Mt. Korinchi: *Meijer 7701, 7708*, etc. (L).

PHILIPPINES. Mindanao, Mt. Apo: *Elmer* 1157c (L); Negros, Cuernos Mts.: *Elmer* 9907 (L).

22. *Bazzania erosa* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Jungermannia erosa* Reinw., Bl., N., Nov. Act. 12, 1824, 230 — *Jungermannia erosa* var. α Nees, Hep. Jav. 1830, 63 — *Mastigobryum erosum* (Reinw., Bl., N.) Lindenb. var. α , in Gottsche, Lindenb. et Nees., Syn. Hep. 1845, 229, Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 49, pl. 16, fig. 1—5.

Plants with shorter leaves than in *B. longicaulis*. Amphigastria generally imbricate, as long as broad or somewhat broader than long, margin with border of hyaline cells, not recurved. In this restricted sense *B. erosa* is not so difficult to distinguish from *B. spiralis*, where the amphigastria are more distant, generally broader than long and recurved at their margin.

The detailed description given by Evans (Pap. Mich. Ac. of Sc. and Arts 17, 1933, 93—97, pl. 16) under the name of this species points to *B. longicaulis*.

Ecology: on branches of trees, exposed to the sun, primary forests 1000—2000 m above sea level.

Distr.: Ceylon, Sumatra, Banka, Java, Celebes, Moluccas, Philippines, Carolines.

CEYLON. herb. v. d. Bosch (L).

JAVA. Without exact locality: *Korthals*, *Zippelius*, *Junghuhn* (L) — West Java: *Teysmann* (L); Salak: *Zollinger* 3560d (L); Tugu: *Kurz* (L); Gegerbintang: *Kurz* (L); ibidem: *Meijer* 516 (BO); Pangrango: *Meijer* 297 (BO); Gede, Tjibeureum: *Meijer* 409, 4091 (BO); Kandang Badak: *Van der Wijk* 437 (GRON).

SUMATRA. Without exact locality: *Korthals* (L); ibidem: expedition 1878 (L) — West Coast, Mt. Sago: *Meijer* 6228, 6230, 6250 (L); Mt. Korinchi: *Meijer* 6787, 8700 (L); Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 2015f (BO) — East Coast, Brastagi: *Van der Wijk* 1651b (GRON).

BANKA, inter Klappa et Prang: *Kurz*, mixed with *B. spiralis* (L).

CELEBES. Tjamba: *Simon Thomas* (L).

HALMAHEIRA: *De Vriese* (L).

CAROLINE ISLANDS. Ponaape, Mt. Poaipoi: *Glassmann* 2489 (L).

23. *Bazzania spiralis* (Reinw., Bl., N.) Meijer, comb. nov. — *Jungermannia spiralis* Reinw., Bl., N., Nov. Act. 12, 1824, 231 — *Mastigobryum spirale* (Reinw., Bl., N.) Steph., Bull. Herb. Boiss. II. 8, 1908, 857; Sp. Hep. 3, 1908, 481 — *Bazzania schildii* Herz., Ann. Nat. Hist. Mus. Wien 53, 1943, 366 — *Jungermannia erosa* var. β Nees p.p., Hep. Jav., 1830, 63 — *Mastigobryum erosum* var. β Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 229; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 99, pl. 16, fig. 6—9.

Plants with oblong leaves, leaf lobes sometimes confluent with the serrulation, dorsal base of leaf occasionally with small appendages, amphigastria distant, broader than long, margin serrulate (or entire) with hyaline border, recurved. Forms with bigger and more imbricate amphigastria are not easily separable from *B. erosa*, but as both forms can grow together and then remain distinct, it does not seem likely that they belong to one single species.

Ecology: on branches of trees.

Distr.: Malaya, Banka, Sumatra, Java, Borneo.

JAVA. Without exact locality and collector (L).

SUMATRA. West Coast: *André Wiltens* (L); ibidem: *Schild* (Herzog loc. cit.).

BANKA, Mt. Maras: v. *Diest* (L); inter Klappa et Prang: *Kurz* (L).

MALAYA. Pahang: *Henderson 32* (GRON).

BORNEO, Mt. Sakumbang: *Korthals* (L) — North Borneo, Kinabalu: *J. Whitehead* (BM).

HALMAHEIRA: *Pleyte 391b* (BO).

24. *Bazzania desciscens* (Steph.) Meijer, comb. nov. — *Mastigobryum desciscens* Steph., Bull. Herb. Boiss. II. 8, 1908, 862; Sp. Hep. 3, 1908, 487 — *Mastigobryum erosum* var. γ Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep., 1845, 229; Lindenberg et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 99, pl. 16, fig. 9—12.

Plants with narrow-oblong, somewhat falcate leaves, amphigastria broader than long, without hyaline border, apex reflexed. Differs from *B. indica* especially by the different type of leaf and cell net and from *B. erosa* and *B. spiralis* by its narrower leaves and the lack of a hyaline border in the amphigastria.

Distr.: Sumatra, Java.

JAVA. West Java, Mt. Megamendung 1200 m: *Verdoorn 3077* (BO).

SUMATRA. West Coast: *Teymann* (L); Mt. Tandikat 2000 m: *Meijer 6293* (L).

25. *Bazzania indica* (Gottsche et Lindenb.) Trev., Mem. Ist. Lomb. 13, 1877, 414 — *Mastigobryum indicum* Gottsche et Lindenb., in Gottsche, Lindenberg et Nees, Syn. Hep., 1845, 230; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 102, pl. 19.

Diagnostic characters: oval-ovate leaves, sometimes with indistinct lobes, along upper margin generally sharply serrulate. Amphigastria more or less quadrate, margin serrulate, without hyaline border, recurved. Leaves and amphigastria all densely imbricate.

Distr.: Sumatra, Java, Borneo.

JAVA. Without exact locality and collector, herb. *Dozy & Molkenboer* (L), ibidem: *Korthals*, *Zippehus* (L) — West Java, Mt. Gede, Tjibodas, Mt. Garden: *Meijer 3739* (BO); path to Tjibeureum: *Van der Wijk 125* (GRON); Mt. Guntur: *Verdoorn 1662* (BO).

SUMATRA. Without exact locality: *Korthals* (L) — West Coast: *André Wiltens* (L); Pajakumbuh, Mt. Sago: *Meijer 6249, 6255* (L) — East Coast, Brastagi: *Van der Wijk 1641* (GRON).

BORNEO. Without exact locality and collector (L).

VII. INTEGRIFOLIAE

This section is closely related to the section *Serrulatae*. All species show also serrulate leaves, the only difference being that no special leaf lobes are visible.

26. *Bazzania loricata* (Reinw., Bl., Nees) Trev., Mem. Ist. Lomb. 13, 1877, 414; Evans, Pap. Mich. Ac. Sc. 17, 1933, 70, pl. 13 — *Jungermannia loricata* Reinw., Bl., Nees, Nov. Act. 12, 1824, 233 — *Mastigobryum loricatum* Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 217; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 12, pl. 4.

The most striking characters of this species are: imbricate, oblong leaves and rounded rectangular amphigastria, the latter hyaline-bordered. Leaf cells with bulging trigones. *Mastigobryum insignis* De Not., from

Borneo, is a related species, with entire or slightly 3-lobed leaves and amphigastria not bordered by hyaline cells. *Bazzania recurva* (Mont.) Trevis differs both from this and from *B. loricata* by its rounder leaves, its amphigastria with recurved margin and its very thick incrassate cell walls.

Ecology: growing on decaying wood in mountain forests.

Distr.: Sumatra, Java.

JAVA. Without exact locality: *Junghuhn* (L) — West Java: *Teysmann* (L); Salak: *Kurz* (L); Mt. Gede: *Zippelius* (L).

SUMATRA. West Coast, Mt. Sago: *Meijer* 6226, 6232 (L), etc. Also mentioned by Evans (loc. cit.) from Sumatra.

27. *Bazzania distans* (Nees) Trev., Mem. Ist. Lomb. 13, 1877, 414 — *Jungermannia distans* Nees, Hep. Jav. 1830, 65 — *Mastigobryum distans* Lindenb., in Gott., Lindenb. et Nees, Syn. Hep. 1845, 216; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi 1851, 4, pl. 1 — *Calypogeia* ? *distans* St., Hedwigia 25, 1886, 239.

Delicate plants, in habit resembling a species of *Calypogeia*, differing, however, by its cells with trigones and its leaves which are serrulate at their apex. Margin of amphigastria somewhat recurved. Leaves and amphigastria rather distant. The whole plant looks like a depauperate form of *B. loricata*.

Distr.: Sumatra, Java.

JAVA. West Java, Mt. Salak: *Kurz* (L); Megamendung, Tugu: *Kurz* (L).

SUMATRA. West Coast, Mt. Singgalang, 2800 m: *Meijer* 7384b (L).

Index to scientific names

Synonyms in *italics*. Numbers refer to those of the species in the text; I means Introduction. An asterisk * denotes a new taxon, name, or combination.

BAZZANIA

acutifolia (I)
borneensis Steph. (8)
calcarata (Lac.) Schiffn. (18)
commutata (Lindenb. et Gottsche)
Schiffn. (20)
concinna (De Not.) Trev. (10)
concinna De Not. (8)
connata (Steph.) Schiffn. (8)
conophylla (Lac.) Schiffn. (I, 9)
densa (Lac.) Schiffn. (6, 8)
*desciscens (Steph.) Meijer (24)
diminuta (I)
distans (Nees) Trev. (27)
erosa (Reinw., Bl., N.) Trev. (21,
22, 23, 24)
everetti Steph. (I, 15)
fallax (Lac.) Schiffn. (1)
flavescens (Steph.) Schiffn. (4)
fuscescens (I)
*gedeana (Steph.) Meijer (16, 17)
gibba (Lac.) Schiffn. (15)
harpago (I)

*herzogiana Meijer (3)
horridula (I)
indica (Gottsche et Lindenb.) Trev.
(20, 24, 25)
intermedia (Lindenb. et Gottsche)
Trev. (10)
javanica (Lac.) Schiffn. (13)
lanceifolia Steph. (18)
linguaeformis (Lac.) Schiffn. (19)
longicaulis (Lac.) Schiffn. (21, 22)
loricata (Reinw., Bl., Nees) Trev.
(26, 27).
luzonensis (Steph.) (4)
miqueliana (Lehm.) Schiffn. (20)
paradoxa (Lac.) Schiffn. (17)
paradoxa (Lac.) Steph. (17)
patentistipa (Lac.) Schiffn. (9)
patentistipula (I)
pectinata (Lindenb. et Gottsche)
Schiffn. (6, 8)
praerupta (Reinw., Bl., N.) Trev.
(11, 12, 13)
recurva (Mont.) Trev. (I, 26)

- remotifolia* Herz. (3)
remotifolia Horikawa (3)
renistipula (I)
richardsii Herzog (18)
sandei Steph. (12)
schildii Herz. (23)
serpentina (Nees) Schiffn. (11)
serpentina (Nees) Trev. (11, 12)
**spiralis* (Reinw., Bl., N.) Meijer
 (20, 22, 23, 24)
subserulata (I)
subtilis (Lac.) Schiffn. (3)
sumatrana (I, Key Sect. V)
sumbavensis (Steph.) Steph. (9)
tridens (Reinw., Bl., N.) Trev. (5,
 6, 9, 10)
uncigera (Reinw., Bl., N.) Trev. (1,
 14, 15)
uncigera var. *fallax* Lac. (1)
**uncigera* var. *gibba* (Lac.) Meijer
 (15)
vittata (Gott.) Trev. (4)
wiltensii (Steph.) Schiffn. (I, 2, 3)
zollingeri (Lindenb.) Trev. (7, 8)
- CALYPOGEIA**
?distans Steph. (27)
- JUNGERMANNIA**
distans Nees (27)
erosa Reinw. (22)
erosa var. α Nees (22)
erosa var. β Nees p.p. (23)
loricata Reinw., Bl., Nees (26)
praeupta Reinw. Bl., N. (12)
serpentina Nees (11)
spiralis Reinw., Bl., N. (23)
tridens Reinw., Bl., N. (5)
tridens var. β Nees (6)
uncigera Reinw., Bl., Nees (14)
- MASTIGOBRYUM**
borneense De Not. (1)
calcaratum Lac. (18)
ceylanicum Mitten (5)
commutatum Lindenb. et Gottsche
 (20)
concinnum De Not. (10)
connatum Steph. (8)
- densum* Lac. (8)
desciscens Steph. (24)
distans Lindenb. (27)
erosum (Reinw., Bl., N.) Lindenb.
 var. α (22)
erosum var. β Lindenb. (23)
erosum var. γ Lindenb. (24)
everetti Steph. (16)
fallax Lac. (1)
flavescens Steph. (4)
fleischeri Steph. (16)
gedeanum Steph. (16)
gibbum Lac. (15)
indicum Gottsche et Lindenb. (25)
insignis De Not. (26)
intermedium Lindenb. et Gottsche
 (10)
javanicum Lac. (13)
linguaeforme Lac. (19)
longicaule Lac. (21)
loricatum Lindenb. (26)
malaccense Steph. (16)
miquelianum Lehm. (20)
olivaceum Steph. (5)
paradoxum Lac. (17)
pectinatum Lindenb. et Gottsche (6)
praeruptum (Reinw., Bl., N.)
 Lindenb. (12)
serpentinum (Nees) Lindenb. (11)
spirale (Reinw., Bl., N.) Steph. (23)
subtile Lac. (3)
sumbavense Steph. (9)
tjibeurum Steph. (5)
tridens Nees (5)
tridens var. β Gottsche, Lindenb. et
 Nees (6)
typicum Steph. (5)
uncigera var. Nees (16)
uncigerum (Reinw., Bl., N.)
 Lindenb. (14)
vittatum Gott. (4)
wiltensii Steph. (2)
zollingeri Lindenb. (7)
- MASTIGOPELMA**
simplex Mitten (4)

PRELIMINARY PLANT-GEOGRAPHICAL ANALYSIS OF THE PACIFIC

as based on the distribution of Phanerogam genera

by

M. M. J. VAN BALGOOY

(University of Leyden)

I. INTRODUCTION

This analysis has been made to find out where the demarcation is situated in the Pacific between the flora of the Old and the New Worlds, and whether this is a sharp line.

Further, it has been tried to subdivide the flora of the Pacific into provinces and districts, and to establish the hierarchy of these subdivisions.

Compare the map at the end of the paper.

The Pacific is defined for this purpose as comprising all islands except Malaysia (in the strict sense of the Flora Malesiana), Hainan, Formosa, the Riukius, Japan, the Kuriles and Aleutians; and, in the south, Tasmania which has been accepted as a part of the Australian Flora. On closer examination it was deemed worthwhile to verify this and add a concise analysis of the Tasmanian flora.

The floristic status of the Bismarek Archipelago, although generally treated as a part of New Guinea, hence of Malaysia, has not yet been properly analysed. For that reason it is included separately in the present work.

On the American side of the Pacific there are a number of islands of which only the Galapagos, San Ambrosio, and Juan Fernandez have been treated as Pacific.

The principles which have been used for the analysis are the same which have been set up by Van Steenis for Malaysia (1950). They are:

(1) The distributional area of the genus or of a significant subdivision (subgenus, section) is the unit of the analysis.

(2) Demarcations between floras are those places where the greatest number of generic areas coincide ('demarcation knots'). They represent critical boundaries where the flora more or less abruptly changes its floristic composition.

(3) The hierarchy of the provinces, districts, subdistricts, etc. is defined in proportion to the number of genera concerned in the demarcation knots.

(4) The genera are classified in a number of categories according to their main centre of development and their distributional area as a whole. In this way a differentiated survey is obtained of each separate area, for which Van Steenis has proposed the term "floristic generic spectrum".

To give an example of point four I mention the genus *Hibbertia* Dill. *) This contains c. 100 species in Australia and Tasmania, further c. 20 in New Caledonia, 2 in New Guinea and the S. Moluccas (both also in Australia), 1 in Fiji, and 1 in Madagascar. I have considered this to be an 'Australian genus' (type 6) and in a flora outside Australia to represent the 'Australian element'.

Crossostylis Rhiz. is only known from the Pacific islands and has been referred to 'Pacific' genera (type 8). A genus such as *Degeneria* Deg., which occurs only in Fiji, has been classified as 'endemic-Pacific' (type 8a).

In the genus *Cyrtandra* Gesn., of which hundreds of species have been described from Malaysia, only 1 occurs in tropical continental Asia, 1 in North Queensland; it is further distributed over the Pacific islands as far as Hawaii and the Marquesas and has been classified as belonging to the Malaysian type (type 5a).

Other genera are distributed much farther in the Old World, as for example *Diospyros* Eben. These have been classified as a separate category (type 4).

Though not all genera can be as easily fitted into a coherent category, the classification of the genera into 15 types has generally not met with great difficulties.

A number of genera were formerly accepted to belong to other categories than accepted here. Their original 'label' was merely due to what I call "priority of description". *Vavaea* Meliac., for example, was originally described from the Pacific islands, but later exploration, identification, and description has proved that this first description was purely accidental and from the margin of the generic area. *Vavaea* has a distinct centre of speciation in Malaysia, and not in the Pacific. Other similar cases are those of *Trimenia* Monim., *Inocarpus* Leg., *Clitandropsis* Apoc., and *Merrilliodendron* Icac. On the other hand I have still accepted *Ascarina* Chlor. as Pacific, although several species are now known as far as New Guinea, the Philippines, and Borneo.

Another case comes up when genera do not show one very clear centre of development, for example *Pittosporum* Pitt.: Africa 19 spp., continental Asia 53, Malaysia 13, Australia 10, New Caledonia 46, New Zealand 20, Hawaii 12. Though the Australasian area is indubitably the focus of the family it would not appear justified to call the genus *Pittosporum* an

) To facilitate orientation of the generic names mentioned in this study I have added for convenience sake the name of the family of the genus in abbreviated form after the generic name.

Australian genus. It has been assigned to type 4, Old World (Palaeotropical) genera.

Nepenthes Nep. is mainly developed in Malaysia, but on the other hand it shows such a wide distribution from Madagascar, Ceylon, and Assam to New Caledonia, that this has been assigned to type 4, palaeotropical genera.

Myoporum Myop. has 30 species in Australia, and though it is true that one species is distributed far outside Australia as far as the Seychelles, SE. Asia, Bonin, and Hawaii, it has been classified among Australian genera (type 6).

However, genera which are richly represented in Australia, but have a significant number of species outside it to remote areas, have been assigned to other groups, for example *Schoenus* Cyp. to type 1, *Mitrasacme* Logan. to type 5b, *Haloragis* Halor. to type 7.

Though I realize that the census of genera on which this study has been based will prove to be incomplete, and that some genera may have to be classified in other types than I have them, it is assumed that the general outcome will be right in the principal points. There is a good indication for this perspective in that, after I had made the first draft, a newly published list of Tonga plants came at hand and a copy of an unpublished Flora of the Bismareks by Father G. Peekel. In both cases the number of genera for these groups was distinctly enlarged, but the nature of the spectrum and its percentages remained almost exactly as they were before.

For this kind of generic analysis there are advantages and disadvantages.

The disadvantages would be far greater if an analysis would be made on the basis of species; this could properly only be performed when a complete critical Flora of the Pacific was available. Besides, species are far more liable to difference of opinion as to their delimitation than genera. Further it would be extremely difficult to classify the 'affinities' of the species, even if well known. In the present state of our knowledge such an endeavour is impossible.

Disadvantages inherent to the generic method are firstly that all genera, large or small, are treated on the same level; secondly, they are not uniformly known, some have been revised, others not.

Further a present species centre may be secondary in nature and the old centre may have now an obsolete importance, being largely extinct. This is specially significant for ancient genera (*Araucaria*, *Nothofagus*, etc.).

This study is, of course not one which can immediately be used for the genesis of the Pacific flora; it offers the floristic raw material and features as they are today.

Besides, a rather large number of genera have been referred to type 1, the worldwide genera; among these there will be a number which could be useful if the affinities of their representatives in the Pacific could be more closely defined. I have refrained from doing this; it would require an intense taxonomical study.

Advantages of the methodology applied here are in the first place that the delimitation and distribution of the genera is far better known and therefore more reliable than that of separate species.

Further, as alluded to above, it would be very difficult to classify species in categories which we need; what is to be done with a species which occurs far apart from the centre of the genus? Would *Stylidium kunthii* Wall. ex DC., which occurs widely in SE. Asia, be considered as representing the 'Asiatic element'?

Genera mostly show a rather coherent generic area of distribution. In the Pacific there are a few, however, which display a remarkably disjunct area, to wit *Chroniochilus* Orch. (1 species, Java & Fiji), *Cossignia* Sapind. (Fiji, New Caledonia, and Mascarenes), *Koelreuteria* Sapind. (E. China, Formosa, and Fiji), *Nesogenes* Verb. (Hawaii & Tuamotu, Rodriguez, Madagascar, and Africa).

Calypsosepalum Sant. (S. Sumatra, Fiji) has been discarded as Van Steenis has just found this to be congeneric with *Drypetes* Euph.

The case for *Chroniochilus* Och. seems not to be a strong one as Holttum, in his work on Malayan orchids, finds this not distinct from *Sarcochilus* which has a much wider distribution.

There are naturally some others which show remote affinity within the Pacific basin; these remain here unmentioned.

With this kind of analysis, which cannot rest upon a critical revision of all genera and species of such a colossal area, certain details must be disposed of, for example those which are connected with a number of ancient, cultivated plants. *Colocasia* Arac., *Cocos* Palm., *Aleurites* Euph., etc. are known to have been cultivated from times immemorial and it is practically impossible to establish, or even estimate, the native area of distribution. Hillebrand (1888) and others assume that in Hawaii certain plants have been introduced by men in prehistoric time, viz *Thespesia* Malv., *Hibiscus tiliaceus* Malv., and *Calophyllum* Gutt. To avoid any uncertainties in the calculations, all these genera which might give rise to some doubt have been omitted in the surveys.

The same holds for those plants which have obviously or probably been imported into the Pacific islands as weeds or aliens or which are cultivated and have naturalized.

In certain cases one genus may have both native species and species which have been introduced, for example in *Apium* Umb., *Chenopodium* Chen., *Eragrostis* Gram., etc. The area accepted for these genera refers only to those places where they are distinctly native, and if there was uncertainty the localities have been omitted, in order to keep the raw material on which this analysis is based as clean as possible.

Unfortunately the synonymy of the genera in the Pacific has never been correlated and integrated in one critical whole. As far as possible I have traced the synonymy, but it is inevitable that more genera will have to be reduced, and others added as critical work on the Pacific flora proceeds. This will also occur with endemic genera, as some will be

added, but others will have to be removed from the list of endemics.

The total number of genera found valid for the present purpose of phytogeographical analysis is 1511, which seems a reasonable basis for statistical purpose.

The survey is naturally not a particularly balanced one, as certain islands have been much better investigated than others and, besides, the amount of published matter varies to a high degree. For instance, Samoa is far less well known as to published records than Fiji, but is better known than the New Hebrides which represent botanically a most undesirable semi-vacuum. The Solomons, which are a most promising country botanically, have mainly been explored for forestry purposes and have never been the subject of an overall botanical exploration.

By presenting in this publication the preliminary concise result of a rather laborious task, it has not been possible to add to it the entire body of factual data on which it was based and the references to the mass of literature from which these data were derived.

If circumstances permit I envisage to embody in a future, larger work a digest of the floristical theories on the affinities of the Pacific flora, an endeavour to correlate a polished version of the present outcome with geographical, geological, and other data, an enumeration of Pacific genera with their detailed distribution, and a complete bibliography.

In addition to the digest of literature I have much profited from the expert help of the following botanists of the Rijksherbarium, Leyden, and of the Foundation Flora Malesiana, who generously provided information: R. C. Bakhuizen van den Brink on *Rubiaceae* and *Apocynaceae*, Ding Hou on *Celastraceae* and *Rhizophoraceae*, J. H. Kern on *Cyperaceae*, P. W. Leenhouts on *Burseraceae*, *Loganiaceae*, and *Goodeniaceae*, S. J. van Ooststroom on *Convolvulaceae*, P. van Royen on *Sapotaceae*, and H. Sleumer on *Ericaceae*, *Proteaceae*, *Epacridaceae*, and *Flacourtiaceae*. Besides, R. D. Hoogland, Canberra, kindly provided data on *Cunoniaceae* and *Saxifragaceae*.

I feel highly honoured and indebted for this kind and loyal assistance.

Special thanks are due to Prof. C. G. G. J. van Steenis on whose initiative I started this subject, who put his files of data at my disposal, and supervised the work.

Leyden, November 1959.

II. THE DISTRIBUTIONAL TYPES OF PACIFIC PHANEROGAM GENERA

The nine distributional types, with 6 additional subtypes, used in this analysis are the following:

Type 1. Worldwides. Genera of this type do not provide data for delimitation of provinces in the Pacific by their occurrence both in the Old and New World. Examples are *Cyperus* Cyp., *Carex* Cyp., *Drosera* Dros., *Tournefortia* Borr., *Commelina* Comm., *Ipomoea* Conv., etc. It is quite well feasible that areas of certain species of these genera could be used, but this falls beyond the project as defined in the present study.

A few genera which are widely distributed in the southern hemisphere have been included in type 1, for example *Pisonia* Nyet., *Pratia* Camp., *Weinmannia* Cun., *Machaerina* Cyp. The circum-Pacific genus *Libocedrus* Conif. has also been placed in type 1.

Type 1a. Temperate worldwides. Genera distributed over the major part of the temperate regions of both hemispheres in the Old and New World, and ascending in the tropics on the mountains; for example *Luzula* Junc., *Coriaria* Cor., *Geum* Ros., *Gentiana* Gent., etc. If in such cases the genus is more distinctly pronounced in either the northern hemisphere (as e.g. *Euphrasia* Scroph. and *Erigeron* Comp.) or the southern one (e.g. *Tetragonia* Aizoac. and *Wahlenbergia* Camp.), they have been classified under group 2 and 7 respectively.

Type 2. Northern temperate type. This category comprises the genera which are principally developed in the northern hemisphere and are typical for temperate Eurasia, often extending over North America, but are not or hardly represented in the southern hemisphere; for example *Crepis* Comp., *Vaccinium*, *Rhododendron* Eric., *Epilobium* Onagr., etc.

Type 3. Continental East Asian and Japanese genera. This type is centred in China and Japan, being temperate to subtropical. In the Pacific it is almost only represented in the Bonin Islands and has obviously had no opportunity to penetrate further. An example is *Bothriospermum* Borr.

A number of such genera, however, have escaped from the East Asian site through the tropics of Malaysia, where they have reached an appreciable development and have from Malaysia spread towards the Pacific. These are arranged here in type 5.

Type 4. Palaeotropical genera. Under this category I understand the genera which range through the tropics and subtropics of the Old World (Africa, Asia, Australia), but do not occur in the New World. They may be absent in Africa. Examples are *Diospyros* Eben. (for the whole range), *Elaeocarpus* Elaeoc. (not in Africa, but in Madagascar), and *Boea* Gesn. (neither in Africa nor in Madagascar). Although *Elaeocarpus* is qua species best developed in Malaysia its area is so large that it should range with type 4.

Type 5. Asiatic-Malaysian genera not represented in Australia, whether or not also in Africa. Some of these may even be abundantly developed in Africa, as for example *Mussaenda* Rub. Further examples are *Globba* Zing., and *Melastoma* Melast.

Type 5a. Malaysian genera. In this group the genera have a pronounced centre in Malaysia; if they occur also in Asia and Australia it is merely with a few outliers or stray species. Examples are *Cyrtandra* Gesn. and *Gonystylus* Thym.

Type 5b. Australian-Malaysian genera. These genera have, in Malaysia, mostly the largest development in its Eastern province, focussed frequently in New Guinea and Northern to Eastern Australia. None of them is represented in continental Asia. Typical examples are *Pandorea* Bign., *Agathis* Con., *Aceratium* Elaeoc., *Deplanchea* Bign., *Homalanthus* Euph.

Type 6. Australian genera. Under this category fall genera which are overwhelmingly developed in Australia though they may have some stray representatives or specimens in far flung localities from that continent. A typical example is *Hibbertia* Dill., with over 100 species in Australia, 20 in New Caledonia, 2 in New Guinea and the S. Moluccas (both known also from Australia), 1 in Fiji, and 1 in Madagascar. Another example is *Styphelia* Epaer.

Type 7. Subantarctic-Pacific genera. This group comprises the genera which find their main distribution over the temperate part of the South Pacific in the southern hemisphere: SE. Australia, Tasmania, New Zealand, the subantarctic islands, and temperate South America. Some genera range throughout that area, for example *Nothofagus* Fag.; others are of more limited distribution, for example *Corokia* Sax.

Type 7a. Subantarctic-Indian Ocean genera. This is a small subsection of type 7 comprising those genera which fail to occur in South America, but are found from New Zealand westward via Tasmania or South Australia to South Africa. This interesting group is only very small and as far as I know contains only 8 genera, viz *Cassinia*, *Helichrysum* Comp., *Lobelia* sect. *Mezliera* Camp., *Sebaea* Gent., *Pelargonium* Geran., *Moraea* Irid., *Bulbinella* Lil., and *Australina* Urt.

Type 7b. Pan-Subantarctic genera. This is an equally small group of genera, as interesting as the preceding one, containing genera which have a still much wider distribution throughout the antarctic region, and which occur in or on islands near all three continents of the New and Old Worlds. Sometimes a single species has reached or even overstepped the equator (via the mountain ranges) and has reached continental Asia or Malaysia (*Nertera* Rub., *Leptocarpus* Rest., *Acaena* Ros., *Wahlenbergia* Camp.). They are the following: *Mesembryanthemum*, *Tetragonia* Aizoac., *Brachycome* Comp., *Carpha* Cyp., *Sophora* sect. *Edwardsia* Leg., *Leptocarpus* Rest., *Acaena* Ros., *Nertera* Rub., *Azorella* Umb., and *Wahlenbergia* Camp.

Type 8. Pacific genera. These are genera which distinctly center in the Pacific, including naturally also New Caledonia and New Zealand. Sometimes the Pacific origin is beyond doubt, as for example in *Crossostylis* Rhiz. and *Kermadecia* Prot., which do not occur beyond Pacific borders. Their number has been marked with an asterisk * in the survey (p. 392). In some other cases Pacific genera have got that name because they were known only from the Pacific for a very long time, but have

more recently also been found to occur in Malaysia or Queensland as for example *Trimenia* Monim., *Vavaea* Meliac., *Couthovia* Logan., and in some cases there is now even a slight majority of species found in Malaysia as compared with the Pacific.

Type 8a. Endemic Pacific genera. Some of these are local endemic genera known from a single island only, as in the outstanding example of *Degeneria* Deg. in Fiji. But to this category I have also reckoned a number of genera which are confined to a limited group of islands situated close together, as for example New Caledonia and Loyalty Is., the Samoa group, the Fiji group, the Hawaiian group, etc. Of these genera I have tried to find data on their affinity, for example that of *Charpentiera* Amarant. from Hawaii is American, that of *Robinsonia* Comp. from Juan Fernandez is Papuan, that of *Entelea* Til. fom New Zealand is African!

Type 9. Tropical or subtropical American genera. This group is small and its occurrence in the Pacific is almost confined to the Galapagos Is., as for example *Laguncularia* Combr. (which also occurs in West Africa). There are, however, some which show a distinct crossing over the entire Pacific, beyond the temperate to cold Subantarctic, as for example *Nicotiana* Sol.

III. SURVEY OF ALL THE GENERA SEGREGATED INTO TYPES

Types	Number of genera	Percentage
Type 1	334	22.1 %
Type 1a	40	2.7 %
Type 2	46	3.0 %
Type 3	10	0.7 %
Type 4	244	16.1 %
Type 5	118	7.8 %
Type 5a	96	6.4 %
Type 5b	42	2.8 %
Type 6	97	6.5 %
Type 7	51	3.4 %
Type 7a	8	0.5 %
Type 7b	10	0.7 %
Type 8	88	5.8 %
(8*)	(53)	
Type 8a	233	15.4 %
Type 9	94	6.2 %
Total	1511	100.1 %

IV. FLORISTIC SPECTRA FOR THE PACIFIC ISLAND GROUPS AND DISCUSSION OF THEIR STATUS

In the following local surveys of the island groups the sequence chosen is from West to East in two major series, one from Bonin across Micronesia and Melanesia to Hawaii, and the second from New Caledonia and New Zealand via Juan Fernandez to Galapagos.

In order to give an approximate idea of the position on the globe and the size and nature of the islands, the latitude, longitude, area in sq.km, and approximate highest altitude in metres have been given.

1. Bonin Islands

25—28° N, 140—143° E; surface 80 sq.km; altitude 320 m

Types	Number of genera	Percentage	
Type 1	91	51.7 %	
Type 1a	5	2.9 %	
Type 2	25	14.3 %	
Type 3	8	4.6 %	
Type 4	31	17.8 %	
Type 5	5	2.9 %	} 4.7 %
Type 5a	1	0.6 %	
Type 5b	2	1.2 %	
Type 6	1	0.6 %	
Type 7	—	—	
Type 7a	—	—	
Type 7b	1	0.6 %	
Type 8	2	1.2 %	
Type 8a	3	1.7 %	
Type 9	—	—	
Total	175	100.1 %	

Discussion: In this spectrum types 2 and 3 are proportionally abundantly represented, far more than in any other island group to follow. This shows the great affinity with the East Asian mainland of China, Siberia, and Japan, and the sharp demarcation against the true Pacific islands. The spectrum of the flora is more boreal and East Asian than in any other group.

Types 4 and 5 show, furthermore, a rather large number of tropical genera, but the percentage of Malaysian elements is not particularly large. One genus (type 5a), viz *Paralstonia* Apoc., is confined to Bonin and the Philippines.

The Pacific element (type 8) is very small.

The three endemic genera (*Dendrocacalia* Comp., *Platypholis* Orob., *Boninia* Rub.) show a (rather feeble) indication of individuality. Only seven genera (incl. the three endemics), or 4 %, are not found in Asia or Japan.

The conclusion is that the Bonin Islands should not be considered a province of the Pacific flora but undoubtedly make part of the East Asian flora.

Comparison with the flora of the Marianas. The spectrum differs markedly from that of the Marianas, especially if we take into consideration the relatively small distance between these two groups which form superficially one arc. In comparing the spectra it appears that the difference lies in the types 1a, 2, and 3 (East Asian and temperate northern), amounting to 37 genera or ± 21 % in the Bonins against 1 or 0.5 % in the Marianas, a most significant proportion.

Comparing the Bonins and Marianas we find that Bonin has 175 genera (incl. 3 endemics) and the Marianas 217 genera (incl. 1 endemic).

Common to both groups are 86 genera; in Bonin occur 89 genera not known from the Marianas. Conversely 131 genera of the Marianas are not found in the Bonins. The demarcation thus amounts to $89 + 131 = 220$ genera, i. e. 72 % of the total number of genera (306) found in both groups together.

A curious case is *Santalum* Sant. which occurs throughout the Pacific, but has never been found in the Marianas and Carolines!

2. Marianas

13—20° N, 144—146° E; surface 640 sq.km; altitude 400 m

Types	Number of genera	Percentage
Type 1	134	61.1 %
Type 1a	1	0.5 %
Type 2	—	—
Type 3	—	—
Type 4	54	25.4 %
Type 5	13	6.0 %
Type 5a	6	2.7 %
Type 5b	1	0.5 %
Type 6	3	1.4 %
Type 7	—	—
Type 7a	—	—
Type 7b	—	—
Type 8	4	1.9 %
Type 8a	1	0.5 %
Type 9	—	—
Total	217	100.0 %

Discussion: As can be observed from the figures under types 1a, 2, and 3 the affinity with East Asia is extremely small.

In contrast the affinity with Malaysian tropics is larger (groups 5—5b) and there is a distinct increase in Palaeotropical elements (group 4).

The genera of the Marianas are all found in Malaysia except the one endemic genus *Guamia* Ann.

On the other hand the Marianas have 14 genera (6.5 %) which are not found in continental Asia; of these 6 belong to type 5a, 1 to type 5b, 2 to type 6, 4 to type 8, and 1 to type 8a.

The demarcation between Bonin and Marianas. In comparing the genera from both groups we can oppose the Northern and Western genera which end their distribution in the Bonins to the Eastern and Southern genera which end their distribution area in the Marianas. In doing this we get the following figures:

For Bonin:	in types 1a and 2.....	28 genera
	in type 3	8 genera
	in types 4, 5, and 5a	6 genera
	endemic	3 genera

Totaal 45 genera

For the Marianas:	in types 4 and 5	46 genera
	in types 5a and 5b	6 genera
	in types 6 and 8a	6 genera
	endemic	1 genus

Totaal 59 genera

As we have seen in the section on the Bonin Islands there is a marked gap of 220 genera, i. e. 72 % of the total number of genera, between Bonin and the Marianas.

Conclusion: The Marianas distinctly belong to the Malaysian floral district.

In order to find out their closest affinity I have tried to find out how many genera the Marianas share with the Philippines, but not found in New Guinea, and those shared by Marianas and New Guinea that do not occur in the Philippines.

The Marianas share 6 genera with New Guinea which are not found in the Philippines. They are: *Bleekeria* Apoc., *Fenzlia* Myrt., *Merrilliodendron* Icac., *Meryta* Aral., *Pachygone* Menisp., and *Sacciolepis* Gram.

There are 2 genera shared by the Marianas and the Philippines which are not recorded for New Guinea, viz *Cantharospermum* and *Teramnus* Leg. Both are wide-spread plants of \pm anthropogenous country.

This appears to be a slight discrepancy only, but still induces me to include the Marianas in a subdistrict of East Malaysia.

3a. West Carolines and Palau

7—10° N, 132—145° E;
surface 600 sq.km;
altitude 240 m

3b. East Carolines

5—9° N, 145—163° E;
surface 700 sq.km;
altitude 790 m

Types	Number of genera	Percentage	Number of genera	Percentage
Type 1	151	42.9 %	113	47.5 %
Type 1a	—	—	—	—
Type 2	—	—	—	—
Type 3	1	0.3 %	1	0.4 %
Type 4	99	29.1 %	65	28.4 %
Type 5	47	13.8 %	24	10.2 %
Type 5a	26	7.7 %	18	7.6 %
Type 5b	7	2.1 %	3	1.3 %
Type 6	2	0.6 %	1	0.4 %
Type 7	1	0.3 %	—	—
Type 7a	—	—	—	—
Type 7b	—	—	—	—
Type 8	10	2.9 %	9	3.8 %
Type 8a	1	0.3 %	1	0.4 %
Type 9	—	—	—	—
Total	345	100.0 %	235	100.0 %

Discussion: Although from the above contrasted tables it appears that both groups are distinctly similar in character of the spectrum, it appears that the West Carolines, notwithstanding their lower altitude, harbour many more genera. This is mainly to be ascribed to the relative richness of Palau which has, for its small size, a surprisingly varied flora.

(a) *West Carolines.* All genera represented in the West Carolines also occur in Malaysia, 3 excepted, among which is the endemic *Palaoea* Sapind. Further 40 (= 11.8 %) of its genera do not reach the East or Southeast Asiatic mainland.

Pacific elements (type 8) are represented by only 10 genera, of which 8 also occur in Malaysia.

(b) *East Carolines.* The generic relationship between the East Carolines and Malaysia is about equally strong as that of the West Carolines, but the Pacific influence (type 8) is slightly larger. Four genera of the East Carolines do not occur in Malaysia, viz 3 Pacific genera and the endemic genus *Trukia*, Rub. Furthermore, 28 (= 11.9 %) of its genera have not been recorded for the Asiatic mainland.

(c) *Difference and similarity between the West and East Carolines.* The West and East Carolines have together 379 genera, of which they have in common 198 genera = 52.5 %.

The East Carolines have 38 genera not occurring in the West Caro-

lines, and conversely the West Carolines have 142 genera not occurring in the East Carolines; demarcation knot: 47.5 %.

(d) *Demarcation between West Carolines and Marianas*. The demarcation between the West Carolines and the Marianas is more distinct than between the West and East Carolines. The situation is as follows: of the 217 Marianas genera 54 are not found in the West Carolines and conversely from the 345 West Carolines genera 182 do not occur in the Marianas, the total demarcation being 236 genera out of a total of 399, that is 59.1 %.

The number of genera which terminate their distribution in the West Carolines and do not occur in the Marianas or East Carolines is 72, which belong to types 4 and 5—5b, with of course the endemic *Palaoea*.

The conclusion is that there are distinct demarcations both between the West Carolines and the Marianas and between the West and East Carolines; they are of about equal magnitude.

(e) *The relation between the Carolines and the Philippines and New Guinea*. For this aim it seems convenient to combine the entire flora of the West and East Carolines in one survey:

Carolines

Types	Number of genera	Percentage
Type 1	159	42.0 %
Type 1a	—	—
Type 2	—	—
Type 3	1	0.3 %
Type 4	113	29.8 %
Type 5	49	12.9 %
Type 5a	30	7.9 %
Type 5b	9	2.4 %
Type 6	2	0.5 %
Type 7	1	0.3 %
Type 7a	—	—
Type 7b	—	—
Type 8	12	3.2 %
Type 8a	3	0.8 %
Type 9	—	—
Total	379	100.1 %

The relation can be tested by the number of genera that do not occur in both Philippines and New Guinea, but only in one of these two districts. In doing this it appears that there are 2 genera which the Carolines have in common with the Philippines which do not occur in New Guinea. These are: *Scirpodendron* Cyp. and *Symplocos* § *Bobua*

Sympl. Conversely there are 18 genera which are shared by the Carolines and New Guinea and do not occur in the Philippines, viz:

<i>Aglossorrhyncha</i> Orch.	<i>Lophopyxis</i> Euph.
<i>Campnosperma</i> Anac.	<i>Mediocalcar</i> Orch.
<i>Clitandropsis</i> Apoc.	<i>Merrilliodendron</i> Icac.
<i>Fenzlia</i> Myrt.	<i>Meryta</i> Aral.
<i>Finschia</i> Prot.	<i>Pentaphalangium</i> Gutt.
<i>Gulubia</i> Palm.	<i>Pseuderia</i> Orch.
<i>Gymnosiphon</i> sect. <i>Gymno-</i>	<i>Sacciolepis</i> Gram.
<i>siphon</i> Burm.	<i>Salacicratea</i> Hippoc.
<i>Haplolobus</i> Burs.	<i>Soulamea</i> Simaroub.
<i>Loeseneriella</i> Hippoc.	

It appears, therefore, that the Carolines should be joined to the East Malaysian Province, and not to the Philippines (West Malaysian Prov.).

**4. Marshall, Gilbert, and Ellice Islands,
including also Line, Phoenix, and Tokelau Islands**

10° S—20° N, 175° E—150° W; surface 1000 sq.km;
highest altitude 5 m

Marshall, Gilbert, Ellice			Line, Phoenix, Tokelau	
Types	Number of genera	Percentage	Number of genera	Percentage
Type 1	43	68.3 %	31	86.1 %
Type 1a	—	—	—	—
Type 2	—	—	—	—
Type 3	—	—	—	—
Type 4	15	23.8 %	3	8.3 %
Type 5	2	3.2 %	1	2.8 %
Type 5a	—	—	—	—
Type 5b	—	—	—	—
Type 6	—	—	—	—
Type 7	—	—	—	—
Type 7a	—	—	—	—
Type 7b	—	—	—	—
Type 8	3	4.7 %	1	2.8 %
Type 8a	—	—	—	—
Type 9	—	—	—	—
Total	63	100.0 %	36	100.0 %

Central Pacific (combined)

Types	Number of genera	Percentage
Type 1	49	71.0 %
Type 1a	—	—
Type 2	—	—
Type 3	—	—
Type 4	15	21.7 %
Type 5	2	3.0 %
Type 5a	—	—
Type 5b	—	—
Type 6	—	—
Type 7	—	—
Type 7a	—	—
Type 7b	—	—
Type 8	3	4.3 %
Type 8a	—	—
Type 9	—	—
Total	69	100.0 %

Discussion: The reason for taking these widely diffused islands together is because they have practically no significance from the plant-geographical point of view and share the general features of low coral flats and atolls. Their flora mainly consists of wide-spread tropical shore plants of the *pescaprae* and *Barringtonia* formations. Though from their situation in the middle of the Pacific one would expect a high percentage of the Pacific type 8, this appears hardly represented.

Conclusion: The group belongs certainly to the Old World tropics, but it cannot be defined as a separate province by lack of character.

5. Bismarck Archipelago

Discussion: Though situated in the immediate vicinity of New Guinea, it appeared worthwhile to establish the percentages, especially in relation with the Solomons, which form superficially an elongation of New Ireland.

Unfortunately the Bismarcks are not a particularly well explored area and publications on it are relatively scarce. At Berlin the Herbarium formerly started a series of publications on this group and Micronesia, but this was soon abandoned. In other publications authors frequently merge the Bismarck records with those of New Guinea and omit to mention any separate records.

As far as I could trace 525 genera have been recorded in literature; from this figure I have deleted 11 in which it is not quite certain that

1—6°S, 146—153° W; surface 50.000 sq.km; altitude 2400 m

Types	Number of genera	Percentage
Type 1	194	37.8 %
Type 1a	1	0.2 %
Type 2	1	0.2 %
Type 3	—	—
Type 4	152	29.6 %
Type 5	71	13.8 %
Type 5a	52	10.2 %
Type 5b	23	4.5 %
Type 6	7	1.4 %
Type 7	1	0.2 %
Type 7a	—	—
Type 7b	—	—
Type 8	11	2.0 %
Type 8a	1	0.2 %
Type 9	—	—
Total	514	100.0 %

they are indigenous, as for example *Melia* Meliac., *Aleurites* Euph., etc. This leaves a clean total of 514.

Among these only 3 genera have not yet been recorded for Malaysia, viz *Maytenus* Celastr., *Nasturtium* sect. *Ceriosperma* Cruc., and *Clymenia* Rut.

The affinity is largest with New Guinea, with which they share not less than 508 genera (98.5 %).

Besides, the Bismarks share with New Guinea 4 genera which have never been recorded from elsewhere, viz *Calycacanthus* Acanth., *Tripetalum* Gutt., *Antiaropsis* Morac. and *Peckelia* Leg., whereas quite a few genera are found outside New Guinea and the Bismarcks only in the Moluccas or the Solomons. The only endemic genus is: *Clymenia* Rut.

Among the 11 Pacific genera of type 8 there are none which are absent from Malaysia.

Many palaeotropical genera end their distribution in the Bismarcks, though their number is smaller than has been found for the Solomons. They are distributed over the types as follows:

Genera which terminate their distribution in the Bismarcks:

Type 1	8 genera	Type 5a.....	13 genera
Type 4	12 genera	Type 5b.....	6 genera
Type 5	22 genera	Type 6	2 genera
		Total	63 genera

Concerning the relation with other adjacent island groups it appears that there is a much stronger affinity with the Solomons than with the Carolines. Of the 514 Bismarek genera 242 do not occur in the Carolines, and conversely of the 379 Carolines genera 107 do not occur in the Bismareks; the demarcation being in all 349 genera, or 53 % of the total number of genera in both groups.

In applying the same considerations to the Solomons the figures are as follows: of the 514 Bismarek genera 179 do not occur in the Solomons, and conversely of the 431 Solomon genera 87 do not occur in the Bismareks; together amounting to a demarcation of 266 genera or 44 % of the total number of genera in both groups.

Conclusion: In conclusion the situation induces us to subordinate the Bismareks to the East Malaysian Province without possibility of defining it as a separate district, but joining it immediately to Papuasias.

6. Solomon Islands

5—11° S, 154—162° E; surface 42,500 sq.km; altitude 2700 m

Types	Number of genera	Percentages
Type 1	150	34.8 %
Type 1a	—	—
Type 2	3	0.7 %
Type 3	—	—
Type 4	122	28.3 %
Type 5	44	10.2 %
Type 5a	56	13.0 %
Type 5b	19	4.4 %
Type 6	6	1.4 %
Type 7	3	0.7 %
Type 7a	—	—
Type 7b	—	—
Type 8	23	5.3 %
Type 8a	3	0.7 %
Type 9	2	0.5 %
Total	431	100.0 %

Discussion: The state of exploration and publication is no better for the Solomons than it is for the Bismareks. The exploration has been done largely for purposes of forestry and proportionally little attention has been paid to the herbaceous flora.

From the figures above it appears clearly that the flora of the Solomons is closest allied to that of Malaysia and very remote from that of Australia, the percentages of types 5—5b being 27.6 % against that of type 6 being only 1.4 %.

The Pacific element is somewhat better represented in the Solomons than in the Bismarcks, which appears from the following comparison. The Bismarcks have 11 Pacific genera (2.7 %) all of which are also found in Malaysia. The Solomons, however, have 23 (5.3 %), 10 of which do not reach Malaysia.

Besides, the Solomons have somewhat more individuality due to the presence of three endemic genera, all palms, viz *Paragulubia*, *Pritchardiopsis*, and *Rehderophoenix*.

The demarcation between the Solomons and New Hebrides is more distinct than many other demarcations in the Pacific. A considerable number of paleotropical, especially Malaysian genera, terminate their distribution in the Solomons. Besides, a number of genera from other types also find the limit of their distribution in the Solomons. Their spectrum is as follows:

Genera penetrating into the Pacific as far as and including the Solomons:

Type 1	10 genera	Type 5a.....	31 genera
Type 2	2 genera	Type 5b.....	4 genera
Type 4	24 genera	Type 6	1 genus
Type 5	22 genera	Type 8a.....	3 genera
		Total	97 genera

The 10 genera of type 1, though world-wide in distribution, are known in the Pacific only as far east as the Solomons and so virtually terminate their distribution in this island group. Conversely there is a significant number of Pacific and other southern and eastern genera which occur in the New Hebrides but have not been found in the Solomons. Their spectrum is:

Genera terminating their area in the New Hebrides with relation to the Solomon Islands:

Type 1a	2 genera
Type 6	8 genera
Type 7	2 genera
Type 8	22 genera
Type 8a	2 genera
Total	36 genera

The complete demarcation knot between the Bismarcks, Solomons, and New Hebrides are as follows: 179 Bismarek genera do not occur in the Solomons, 87 Solomon Is. genera do not occur in the Bismarcks, demarcation knot 266 genera on a total of 601 = 44.2 %.

Furthermore 201 Solomon Is. genera do not occur in the New Hebrides, 141 New Hebrides genera are not recorded from the Solomons, demarcation knot 342 genera on a total of 572 = 60.0 %. Probably the latter figure

is too high because a number of the New Hebrides genera are known in the Bismarcks, which points to an under-exploration or publication of the Solomon Is. flora. The demarcation between Solomons and New Hebrides is further accentuated by the percentage of Pacific genera (type 8) amounting to 5.3 % and 10.5 % respectively. Also many genera are known from the Solomons and Fiji which have not yet been recorded from the New Hebrides. I expect that the demarcation percentages will decrease with intensified exploration and publication.

It is remarkable that neither in the Solomons nor in the Bismarcks representatives have been recorded of the *Dipterocarpaceae* though they are still represented with 3 genera in the most eastern islands of the Louisiades. This is also valid for *Quercus* sens. lat. and *Castanopsis* Fag., *Ericaceae*, *Melastomataceae*, etc. which are almost absent east of New Guinea.

Conclusion: The Solomon Islands form a distinct part of the East Malaysian flora. However, there is a distinct demarcation in the west against New Guinea and the Bismarcks, and a still more significant demarcation against the New Hebrides flora in the east. Therefore, the Solomon Islands flora deserves a separate status as a district.

7. New Hebrides

12—20° S, 166—170° E; surface 15.000 sq.km; altitude 1800 m

Types	Number of genera	Percentage
Type 1	135	36.4 %
Type 1a	2	0.5 %
Type 2	2	0.5 %
Type 3	—	—
Type 4	107	28.8 %
Type 5	33	8.9 %
Type 5a	24	6.5 %
Type 5b	12	3.2 %
Type 6	12	3.2 %
Type 7	2	0.5 %
Type 7a	—	—
Type 7b	—	—
Type 8	39	10.5 %
Type 8a	2	0.5 %
Type 9	1	0.3 %
Total	371	99.9 %

Discussion: Unfortunately the New Hebrides¹⁾ have been very inade-

¹⁾ The Santa Cruz Islands have been included here in the New Hebrides. They may turn out to be closer allied to the Solomons, but their flora is at present too poorly known.

quately explored, which is the more regrettable as they are situated in a crucial area of plant distribution in the Pacific; from their area and altitude one may expect a much richer flora than is known at the present time. The number of Pacific genera which terminate their distribution in the New Hebrides may be larger and possibly also the number of genera which we know only from New Caledonia, as some endemic New Caledonian genera have later been found also in the New Hebrides.

As to Malaysian and other western genera, the New Hebrides are not such a marked "end-station" as compared with the Solomons, Fiji, or Samoa; if western genera are known from the New Hebrides, they usually also occur in Fiji and/or Samoa/Tonga.

There is in types 5 and 5a, amounting to 33 and 24 genera, a considerable number of orchid genera, viz 14 and 4 genera respectively; this is probably out of proportion as obviously for some reason the intensity of orchid collecting and publication has been more thorough than for other groups.

The two endemic genera known from the New Hebrides are *Trichochilus* Orch. and *Physokentia* Palm.

As an "end-station" for various floristical types the figures for the New Hebrides are: for type 4: 10 genera, for types 5—5a: 10 genera, for types 6 and 8 (Australian and New Caledonian genera): 16 genera, and for "pure" Pacific genera, type 8: 7 genera.

The New Hebrides have one genus in common with Australia, viz *Lysiana* Loranth. and they share 5 genera with New Caledonia which do not occur elsewhere, viz *Alphandia* Euph., *Chambeyronia* Palm., *Cyclophyllum* Rub., *Dizygotheca* and *Strobilopanax* Aral.

There are no purely Malaysian genera which Malaysia and the Solomons share with the New Hebrides. This is in agreement with the fact that the New Hebrides do not represent, as alluded to above, a terminus for typical Malaysian genera.

If we consider the complete survey of the demarcation knots we get the following picture:

(1) Against the Solomons: The New Hebrides have 141 out of 371 genera not occurring in the Solomons, conversely the Solomons have 201 genera out of 431 not occurring in the New Hebrides; demarcation knot consequently 342 genera on a total of 572 = 60.0 %.

(2) Against New Caledonia: The New Hebrides have 88 genera out of 371 not occurring in New Caledonia, conversely New Caledonia has 379 genera out of 662 not occurring in the New Hebrides; demarcation knot consequently 467 on a total of 750 = 62.3 %.

(3) Against Fiji: The New Hebrides have 102 genera out of 371 which do not occur in Fiji, conversely Fiji has 178 genera out of 447 which do not occur in the New Hebrides; demarcation knot consequently 280 genera out of a total of 549 = 51.0 %.

Conclusion: The New Hebrides are in proportion to floristic affinity allied to the surrounding island groups in the sequence Fiji, Solomons, New Caledonia.

8. Fiji Islands

15—10° S, 177° E to 179° W; surface 18.500 sq.km; altitude 1300 m

Types	Number of genera	Percentage
Type 1	174	38.8 %
Type 1a	3	0.7 %
Type 2	1	0.2 %
Type 3	1	0.2 %
Type 4	117	25.0 %
Type 5	42	9.4 %
Type 5a	30	6.7 %
Type 5b	14	3.1 %
Type 6	8	1.8 %
Type 7	3	0.7 %
Type 7a	—	—
Type 7b	—	—
Type 8	41	9.2 %
Type 8a	12	2.7 %
Type 9	3	0.7 %
Total	449	100.0 %

Discussion: The ratios in the spectrum of the Fiji flora resemble those of the New Hebrides to a most remarkable extent, with the exception of the much more numerous endemic genera (type 8a) in Fiji, the much smaller Australian element (type 6), and a surprisingly larger number of Malaysian genera (types 5—5b), although the distance from Malaysia and from Australia has equally been increased with reference to the New Hebrides. This seems to be a most significant feature.

The 12 endemic genera are the following: *Degeneria* Deg., *Goniocladus*, *Goniosperma*, *Neoveitchia*, *Taveunia* Palm., *Gillespiea*, *Hedstromia*, *Readia*, *Squamellaria*, *Sukunia* Rub., *Amaroria* Simaroub., and *Pimia* Sterc. The monotypic primitive *Degeneria* forms a separate family.

Comparable with the Solomons, Fiji represents a distinct "end-station" of many palaeotropical and Malaysian genera, as has already been emphasized by A. C. Smith (1955). It will appear, however, in the spectral survey of Samoa and Tonga, that a higher percentage of genera find their terminus in these islands, although they are situated beyond the so-called 'andesite line', which has been accepted as the ancient continental border. From East Malaysia the number of Malaysian and palaeotropical genera fades away rather gradually as we proceed eastwards; the gradation shows several minor abrupt discrepancies, namely a feeble one West of the Solomons, a more pronounced one East of the Solomons, a very feeble one between the New Hebrides and Fiji, a rather feeble one between Fiji and Samoa, and a more pronounced one East of Samoa-Tonga.

In all there are 77 western genera that end their distribution in Fiji, which is 17 % of all the Fijian genera. These are distributed over the types as follows: type 3: 1 genus, type 4: 27 genera, type 5: 14 genera, type 5a: 11 genera, type 5b: 5 genera, type 6: 4 genera, and type 8: 15 genera.

Conversely there are only 5 eastern Pacific genera which find their most western station in Fiji.

The relations with the four surrounding island groups for finding the demarcation knots are as follows:

(1) Against the New Hebrides: Fiji has 180 genera out of 449 which do not occur in the New Hebrides, conversely the New Hebrides have 102 genera out of 371 not occurring in Fiji; demarcation knot consequently 282 genera on a total of 551 = 51 %.

(2) Against New Caledonia: Fiji has 146 genera out of 449 which do not occur in New Caledonia, conversely New Caledonia has 357 genera out of 662 not occurring in Fiji; demarcation knot consequently 503 genera in a total of 808 genera = 62 %.

(3) Against Tonga: Fiji has 239 genera out of 449 not recorded from Tonga, conversely Tonga has only 39 out of 249 genera not occurring in Fiji; demarcation knot consequently 278 out of 488 genera = 57 %.

(4) Against Samoa: Fiji has 189 genera out of 449 not occurring in Samoa, conversely Samoa has only 43 genera out of 302 not occurring in Fiji; demarcation knot consequently 232 genera out of a total of 491 = 48.5 %.

These figures naturally have only a relative value as the island groups considered are not at all comparable as to size and richness. The number of genera in Samoa and Tonga, which are absent in Fiji, is very low, viz 43 and 39 respectively. In the New Hebrides it is somewhat larger, viz 102, and in New Caledonia it is very much larger, viz 357.

The sizes and altitudes of Samoa, Tonga, New Hebrides, and New Caledonia are: 3600 sq.km/1820 m — 900 sq.km/1000 m — 15000 sq.km/1800 m — 24500 sq.km/1600 m respectively.

Conclusion: Fiji undoubtedly forms an extension towards the Pacific of the Malaysian Province, though to a much lesser extent than for example the Solomons. The closest affinity is with the New Hebrides and as we shall see in the next section a similar relationship exists with Samoa and Tonga; the four will be taken together in one district of the Malaysian Province.

9. Samoa group

13—14° S, 169—174° W; surface 3600 sq.km; altitude 1820 m

Types	Number of genera	Percentage
Type 1	130	43.0 %
Type 1a	1	0.3 %
Type 2	1	0.3 %
Type 3	—	—
Type 4	80	26.5 %
Type 5	24	8.0 %
Type 5a	23	7.6 %
Type 5b	10	3.3 %
Type 6	3	1.0 %
Type 7	2	0.7 %
Type 7a	—	—
Type 7b	1	0.3 %
Type 8	24	8.0 %
Type 8a	2	0.7 %
Type 9	1	0.3 %
Total	302	100.0 %

Discussion: If we compare the spectrum of Samoa with that of Fiji we find a striking resemblance in the composition in all types, with the exception of type 8a, the endemic genera, of which there are only two in Samoa, viz *Coralliokyphos* Orch. and *Sarcopygme* Rub., against twelve in Fiji.

Genera with their distribution ending in Samoa are treated in the next section on Tonga.

10. Tonga group, including Niue

18—22 °, 174—175° W; surface 900 sq.km; altitude 1000 m

Types	Number of genera	Percentage
Type 1	124	50.0 %
Type 1a	—	—
Type 2	—	—
Type 3	—	—
Type 4	72	29.0 %
Type 5	13	5.2 %
Type 5a	7	2.8 %
Type 5b	9	3.6 %
Type 6	3	1.2 %
Type 7	—	—
Type 7a	—	—
Type 7b	2	0.8 %
Type 8	16	6.4 %
Type 8a	—	—
Type 9	3	1.2 %

Discussion: As can be observed from the figures above the spectrum is again to a surprisingly high degree comparable to those of Fiji and Samoa, especially with the latter, as there are no endemic genera. The Tonga group can botanically be considered as a depauperated version of Fiji. This is not unexpected if one takes into consideration the small surface covered by the group.

In comparing type 1 in Fiji, Samoa, and Tonga respectively, it can be observed that the percentage of type 1 (world-wide genera) obviously increases inversely proportional to the size of the islands.

Samoa and Tonga as an "end-station" of western genera. — The number of genera occurring in both groups together is 357 of which 101 genera = 28.1 % find their easternmost station in the Pacific in these islands. They are distributed over the types as follows:

Type 4	39 genera	Type 5b.....	10 genera
Type 5	20 genera	Type 6	3 genera
Type 5a.....	14 genera	Type 8	15 genera
		Total	101 genera

Demarcation between Samoa and Tonga. — Samoa possesses 108 genera which do not occur in Tonga, conversely Tonga has 54 genera which are not recorded from Samoa, which makes a total demarcation of 162 genera out of 357 occurring in both groups together = 45.5 %. This figure is still less than we have found as demarcation between Samoa and Fiji.

The combined generic spectre of Samoa and Tonga is the following:

Types	Number of genera	Percentage
Type 1	155	43.4 %
Type 1a	1	0.3 %
Type 2	1	0.3 %
Type 3	—	—
Type 4	89	24.9 %
Type 5	28	7.8 %
Type 5a	25	7.0 %
Type 5b	12	3.3 %
Type 6	4	1.1 %
Type 7	2	0.6 %
Type 7a	—	—
Type 7b	3	0.9 %
Type 8	31	8.7 %
Type 8a	2	0.6 %
Type 9	4	1.1 %
Total	357	100.0 %

Conclusion on New Hebrides, Fiji, Samoa and Tonga groups: The affinity between the Samoa and Tonga groups is so strong that they should be merged.

Furthermore the spectra of the three groups, New Hebrides, Fiji, and Samoa/Tonga, are so similar that they should form together one separate District of the Malaysian flora.

11. Southeast Polynesian islands

Before venturing on the large archipelagos of the small islands of SE. Polynesia, a few general remarks should be made.

They consist of the Cook Islands, Society Islands, Tubuai including also Rapa, Tuamotu, and Marquesas Islands.

Their flora is generally poor in genera and rather uniform in character. It has only appeared during the analysis that Rapa obviously occupies a position of its own.

The evaluation of the literature appeared far from easy, as some authors cite localities as "Society Is." in a very loose way, as it sometimes appeared that their records really were only from Tuamotu, Cook, or other islands.

I have treated below each island group separately and have finally combined them, with the exception of Rapa.

11a. Cook Islands

19—22° S, 157—160° W; surface 250 sq.km; altitude 650 m

Types	Number of genera	Percentage	
Type 1	85	61.6 %	
Type 1a	—	—	
Type 2	1	0.7 %	
Type 3	—	—	
Type 4	30	21.7 %	
Type 5	4	3.0 %	} 6.7 %
Type 5a	4	3.0 %	
Type 5b	1	0.7 %	
Type 6	2	1.4 %	
Type 7	1	0.7 %	
Type 7a	—	—	
Type 7b	—	—	
Type 8	9	6.5 %	
Type 8a	—	—	
Type 9	1	0.7 %	
Total	138	100.0 %	

Discussion: Between Samoa and Tonga on one side, and Cook and other SE. Polynesian islands on the other, there is obviously a pronounced demarcation. This can for example be demonstrated by the number of western genera occurring on these island groups (and their % of the local number of genera):

Types	Samoa	Tonga	Cook	Society
Type 4	80	72	30	43
Type 5—5b	57	29	9	19
Type 6	3	3	2	2
Total	140	104	41	64
	(= 46.4 %)	(= 41.7 %)	(= 29.8 %)	(= 34.5 %)

East of Samoa/Tonga there is hence a very distinct decrease of western genera.

On the other hand there is no increase of American genera whatsoever (type 9) which would counterbalance the western decrease, nor is there an increase of Pacific elements (type 8).

If we would characterize Cook Is. the definition would be: a distinct part of the palaetropics, with special affinity to Malaysia, and hardly any individuality by the absence of endemic genera (type 8a) and by a high percentage in type 1.

11b. Society Group

12—16° S, 148—155° W; surface 1700 sq.km; altitude 2200 m

Types	Number of genera	Percentage
Type 1	95	51.1 %
Type 1a	1	0.5 %
Type 2	1	0.5 %
Type 3	—	—
Type 4	43	23.1 %
Type 5	10	5.4 %
Type 5a	7	3.8 %
Type 5b	2	1.1 %
Type 6	2	1.1 %
Type 7	3	1.6 %
Type 7a	—	—
Type 7b	1	0.5 %
Type 8	19	10.2 %
Type 8a	1	0.5 %
Type 9	1	0.5 %
Total	186	99.9 %

Discussion: The surface and altitude of the Society Islands are larger than those in Tuamotu Is. which accounts for a richer flora (see 11c.).

A significant character is the still large percentage of palaeotropical genera and a considerable number of Malaysian genera with no increase in American genera and a slight increase of Pacific genera. There is also one endemic genus, *Tahitia* Til. which is said to be closely allied to Malaysian genera.

There is further one American genus, *Fuchsia* Onagr. which also occurs in New Zealand and hence could be placed in type 7 as well.

Among the types 4 and 5, palaeotropical and Malaysian, the number of genera represented by shore plants is playing a preponderant role, such as *Barringtonia* Lec., *Terminalia* Combr., *Pandanus* Pand., etc.. Also orchidaceous genera are common in these two types.

Concluding it may be said with confidence that the flora of the Society Islands is still a distinctly palaeotropical one.

11c. Tuamotu Islands

11—25° S, 125—148° W; surface 940 sq.km; altitude 400 m

Types	Number of genera	Percentage
Type 1	64	68.1 %
Type 1a	—	—
Type 2	—	—
Type 3	—	—
Type 4	17	18.0 %
Type 5	2)	2.1 %
Type 5a	—	—
Type 5b	1)	1.1 %
Type 6	1	1.1 %
Type 7	1	1.1 %
Type 7a	—	—
Type 7b	—	—
Type 8	8	8.5 %
Type 8a	—	—
Type 9	—	—
Total	92	100.0 %

Discussion: The surface of the archipelago is very large, but the actual amount of land is very small with distant islets. A large number of these islands consist of low coral islets and atolls generally with a very poor littoral flora. Only the most southern islands show any character with elevations up to 400 m, such as Mangareva, Pitcairn, Henderson I., etc. They form one continuous series with the Cook and Tubuai islands group.

Although the Malaysian type (type 5—5b) has dwindled to a very

low percentage, the character is still distinctly palaeotropical through the high percentage in type 4 and the absence of type 9. Generic endemism is also absent.

The conclusion is that there is no appreciable difference in floristic spectrum between the Cooks and Tuamotus.

11d. Marquesas

10° S, 140—139° W; surface 1300 sq.km; altitude c. 1400 m

Types	Number of genera	Percentage
Type 1	68	58.6 %
Type 1a	1	0.9 %
Type 2	1	0.9 %
Type 3	—	—
Type 4	20	17.2 %
Type 5	1	0.9 %
Type 5a	3	2.6 %
Type 5b	—	—
Type 6	2	1.7 %
Type 7	—	—
Type 7a	—	—
Type 7b	—	—
Type 8	17	14.7 %
Type 8a	1	0.9 %
Type 9	2	1.7 %
Total	121	100.1 %

Discussion: All that can be said is that the Marquesas have a larger percentage of Pacific genera, but furthermore that the spectrum is very similar to those of the Society and Tuamotu Islands.

There are two American genera represented, viz *Nicotiana* Sol. and *Dianella* sect. *Archidiana* Lil.; the former is also represented westward to Australia. *Dianella* is a large genus from both the Old and New World tropics. Furthermore there is a rather doubtful record of an American genus, *Diplothemium* Palm.

The subendemic genus *Pelagodoxa* Palm. (also found in Tubuai), said to be allied to American genera, is doubtfully recorded for New Caledonia.

There is one endemic genus, *Cyrtandroidea* Camp. which is allied to Hawaiian genera.

11e. Tubuai, including Rapa

22—28° S, 143—155° W; surface c. 300 sq.km; altitude 660 m

Types	Number of genera	Percentage	
Type 1	65	52.9 %	
Type 1a	5	4.0 %	
Type 2	2	1.6 %	
Type 3	—	—	
Type 4	24	19.5 %	
Type 5	1	0.8 %	3.2 %
Type 5a	2	1.6 %	
Type 5b	1	0.8 %	8.1 %
Type 6	4	3.2 %	
Type 7	6	4.9 %	
Type 7a	—	—	
Type 7b	2	1.6 %	
Type 8	10	8.1 %	
Type 8a	1	0.8 %	
Type 9	—	—	
Total	123	100.0 %	

Discussion: There is no doubt that these islands still belong to the Old World part of the Pacific with no less percentages in types 4 and 5 than in the Marquesas, though less than in Cook and Society Islands. The American type (9) is absent.

Australian genera (type 6) are equal in number to Malaysian ones (*Inocarpus*, *Serianthes* Leg., *Procris* Urt., *Homalanthus* Euph.), two of which are shore plants. Among the 4 Australian genera none is of the shore (*Metrosideros* Myrt., *Olearia* Comp., *Styphelia* Epac., *Myoporum* Myop.).

The list shows much more 'individuality' or 'character' than the hitherto treated island groups of SE. Polynesia. This also appears from the genera of types 1, 1a, and 2, several of which are not found anywhere else in SE. Polynesia, as for example *Senecio* Comp. (affinity in S. America), *Eurya* Theac., *Plantago* sect. *Palaeopsyllium* Plant. (subantaretic affinity), and *Erigeron* Comp. (probably the same species as in Juan Fernandez). The same is found in type 7, which includes for example *Haloragis* Halor. and *Corokia* Sax.

All these remarkable finds come from the isolated island of Rapa and not from Tubuai. The number of genera restricted to Rapa amounts to not less than 21 = 17 %.

The generic spectrum of Rapa reminds one of that of Norfolk Island (see 16b). It makes the impression of an isolated focus in the S. Pacific showing a southern and Australian affinity because, though the number of

genera of type 6 is not particularly high, several genera of types 1 and 7 show Australian—New Zealand affinity.

The individuality of Rapa appears also in the very high specific endemism which amounts to c. 60 % according to F. B. H. Brown (1935). The only endemic genus is *Metatrophis* Morac.

There is also a rather marked Hawaiian influence, often with representatives also in the intervening Society and Marquesas Islands, for example *Lycium* Sol. (even the same species), *Apium* Umb., *Hedyotis* sect. *Oceanica* Rub., *Nesoluma* Sapot., *Astelia* sect. *Asteliopsis* Lil.

Generic spectra of Tubuai and Rapa contrasted

Types	Tubuai (Austral Is.) surface c. 260 sq.km		Rapa surface c. 40 sq.km	
	Number of genera	Percentage	Number of genera	Percentage
Type 1	52	61.2 %	49	51.6 %
Type 1a	—	—	5	5.3 %
Type 2	—	—	2	2.1 %
Type 3	—	—	—	—
Type 4	20	23.5 %	15	15.8 %
Type 5	1	1.2 %	—	—
Type 5a	2	2.3 %	—	—
Type 5b	—	—	2	2.1 %
Type 6	2	2.3 %	4	4.2 %
Type 7	1	1.2 %	6	6.3 %
Type 7a	—	—	—	—
Type 7b	2	2.3 %	2	2.1 %
Type 8	5	6.0 %	9	9.5 %
Type 8a	—	—	1	1.0 %
Type 9	—	—	—	—
Total	85	100.0 %	95	100.0 %

Conclusion: It seems, firstly, that both Rapa and Tubuai must be assigned to the Old World flora; secondly, that Tubuai and Rapa must be separated; thirdly, that with the low percentage of Malaysian genera and the relatively high percentages of Australian and Subantarctic affinity Rapa must be subordinated to the Australian—New Zealand flora.

The status of SE. Polynesia, including the Cook, Society, Marquesas, Tuamotu, and Tubuai Islands (minus Rapa), which are of similar character and should be treated as a whole, must be concluded from the survey on the next page.

From its spectrum it appears that the flora of the SE. Polynesian district is palaeotropical, depauperated Malaysian, sparsely sprinkled with the original Pacific element (types 8—8a), and with a negligible American element. Endemic genera in this district are: *Tahitia* Til. (Society Is.), *Cyrtandroidea*

Southeast Polynesia

Types	Number of genera	Percentage
Type 1	120	50.4 %
Type 1a	2	0.8 %
Type 2	1	0.4 %
Type 3	—	—
Type 4	49	20.6 %
Type 5	13	5.5 %
Type 5a	11	4.7 %
Type 5b	3	1.3 %
Type 6	3	1.3 %
Type 7	2	0.8 %
Type 7a	—	—
Type 7b	2	0.8 %
Type 8	24	10.0 %
Type 8a	5	2.1 %
Type 9	4	1.7 %
Total	238	100.0 %

Camp. (Marquesas), *Apetahia* Camp., *Sclerotheca* Camp., and *Fitchia* Comp. (in more than one group).

Brown (1935) came to the conclusion that the SE. Polynesian islands have a flora with a predominantly American facies, but I cannot agree with his argumentation.

12. Hawaiian Islands and some islets westward

155—180° W, 19—28° N; surface 15,000 sq.km; altitude 4100 m

Types	Number of genera	Percentage
Type 1	111	46.7 %
Type 1a	8	3.4 %
Type 2	8	3.4 %
Type 3	—	—
Type 4	25	10.5 %
Type 5	2	0.8 %
Type 5a	2	0.8 %
Type 5b	—	—
Type 6	3	1.2 %
Type 7	5	2.1 %
Type 7a	—	—
Type 7b	5	2.1 %
Type 8	19	8.0 %
Type 8a	43	18.1 %
Type 9	7	3.0 %
Total	238	100.1 %

Discussion: Compared with island groups of similar size, for instance Fiji, the number of genera is rather small. But the number of endemic genera (type 8a) is exceptionally high, being 43 (Fiji 12).

Furthermore there are a number of genera which are very highly developed in Hawaii and are confined to the Central Pacific, sometimes reaching Melanesia.

Also the number of endemic species is extremely high; besides, the number of species per endemic genus is sometimes very high, up to c. 60 as e. g. in *Cyanea* Camp.

The affinity of the endemic genera is often obscure. Of the others it points to various directions, for example *Charpentiera* Amaranth. is with American affinity, *Brighamia* Camp. has Australian affinity, and *Haplostachys* Lab. has Asiatic-Malaysian affinity.

Some families or tribes are better developed in Hawaii than in any other similarly small part of the world, for example *Campanulaceae*.

In comparing the Old World (types 4—6) and the New World percentages (type 9) it is clear that the Old World element is preponderant, showing a proportion of 13.3:3.

Of the Pacific genera (type 8) 6 reach Malaysia in the west; among these 6 there are 2 which are confined to Malaysia and Hawaii, viz *Tetraplasandra* Aral. and *Tetramolopium* Comp.

There are also 6 Pacific genera reaching as far as Australia; there is one genus confined to New Zealand and Hawaii, viz *Suttonia* Myrs.

Other Pacific genera reach westward only as far as Melanesia, for example *Lipochaeta* Comp. (New Hebrides and Loyalty Is.), *Pritchardia* Palm. (Fiji).

Only 2 Pacific genera reach America, viz *Pritchardia* Palm. and *Astelia* sect. *Asteliopsis* Lil. (Tierra del Fuego).

About 9 Pacific genera centering in Hawaii have a southward area to SE. Polynesia, for example *Nesoluma* Sapot. and *Bidens* sect. *Campylotheca* Comp.

For a group so far north, nearing the tropic of Cancer, the percentage of the subantarctic element (types 7—7b) amounting to 10 genera = 4.2 % is proportionally extremely high. We must bear in mind, of course, that most subantarctic genera are microtherm and that the greatest altitude in the Pacific is found in Hawaii. If the peaks in Fiji or Samoa would have been more lofty at present they would doubtless have harboured a much better representation of subantarctic genera. Therefore, the subantarctic type in Hawaii is to be considered as a relic of an element which was formerly more widely distributed over the Central Pacific islands. Such a condition is at present still found in New Guinea where the colossal highland area possesses a marked subantarctic element.

Conclusion: I consider Hawaii botanically making part of the palaeotropics. It deserves a high status, because of the large number and percentage of endemic genera, and the rather remarkably low percentage of American genera, which gives it a pronounced individuality, probably due to very ancient isolation.

13. New Caledonia

19—23° S, 163—168° E;
surface 23,200 sq.km;
altitude 1600 m

Loyalty Islands

20—23° S, 169—170° E;
surface 1300 sq.km;
altitude 75 m

Types	Number of genera	Percentage	Number of genera	Percentage
Type 1	223	33.8 %	122	47.5 %
Type 1a	8	1.2 %	4	1.5 %
Type 2	3	0.5 %	—	—
Type 3	—	—	—	—
Type 4	138	20.9 %	74	28.9 %
Type 5	26	4.0 %	7	2.7 %
Type 5a	14	2.1 %	2	0.8 %
Type 5b	18	2.7 %	4	1.5 %
Type 6	56	8.5 %	13	5.0 %
Type 7	9	1.3 %	4	1.5 %
Type 7a	1	0.2 %	1	0.4 %
Type 7b	3	0.5 %	2	0.8 %
Type 8	58	8.8 %	21	8.2 %
Type 8a	97	14.7 %	—	—
Type 9	6	0.9 %	3	1.2 %
Total	660	100.0 %	259	100.0 %

Discussion: In the above surveys I have contrasted the figures for New Caledonia and the adjacent Loyalty Islands. The list is undoubtedly incomplete for the Loyalties as no separate enumeration has been published for this group such as we possess for New Caledonia by Guillaumin (1948). Type 1 is better represented in the Loyalties, but this is always a larger figure conversely proportional to the size of the islands. The only significant difference is the slightly larger percentage of type 6 (Australia) in New Caledonia, type 4 (Old World) slightly higher in the Loyalties, and absence of endemic genera in the Loyalty Islands. The latter difference points to the desirability to subordinate the Loyalties to New Caledonia.

This is also emphasized by the fact that there are only 2 genera known from the Loyalty Islands, which do not occur in New Caledonia (*Lipochaeta* Comp. of Hawaii, and *Chariessa* Icac.).

Five genera are entirely restricted to New Caledonia and the Loyalties, viz *Phelline* Aquif., *Anisomallon* Icac., *Cyphokentia* Palm., *Cupaniopsis* sect. *Mizopetalum* Sapind., and *Oxera* Verb.

Further there are 5 other subendemic genera restricted to New Caledonia and New Hebrides, viz *Chambeyronia* Palm., *Cyclophyllum* Rub., *Alphandia* Euph., *Dizygotheca* Aral., and *Strobilopanax* Aral. (the latter two also in the Loyalties).

Conclusion: From the spectra and this discussion I feel that New

Caledonia and the Loyalty Islands cannot be separated and should be joined, as has been suggested in the past. In doing this we get the following combined survey:

13. New Caledonia, Isle of Pines, and Loyalty Islands

19—23° S, 163—170° E; surface 24.500 sq.km; altitude 1600 m

Types	Number of genera	Percentage
Type 1	223	33.8 %
Type 1a	8	1.2 %
Type 2	3	0.5 %
Type 3	—	—
Type 4	138	20.8 %
Type 5	26	3.9 %
Type 5a	14	2.1 %
Type 5b	19	2.9 %
Type 6	56	8.5 %
Type 7	9	1.4 %
Type 7a	1	0.2 %
Type 7b	3	0.5 %
Type 8	54	8.2 %
Type 8a	102	15.4 %
Type 9	6	0.9 %
Total	662	100.2 %

Discussion: In the first place it appears from types 4, 5—5b, and 6 that nearly 40 % of the flora is definitely Old World and only 0.9 % New World *).

But the plant-geographical subordination within the Old World is a difficult question as the Malaysian element (type 5—5b) of 8.9 % is only slightly larger than the Australian element (type 6) of 8.5 %.

If we approach this problem by calculating how many genera New Caledonia shares with Malaysia which do not or hardly occur in Australia against genera shared by New Caledonia and Australia which are not or hardly known from Malaysia, the figures are exactly equal, viz 58.

If we compare the number of genera strictly confined to New Caledonia and Australia with the number of genera strictly confined to New Caledonia and Malaysia, it appears that the former category is the larger one.

*) Even this small percentage, caused by 6 genera, contains most interesting records, viz *Desmanthus* Leg. (Central & South America, Galapagos, New Caledonia), *Leucaena* Leg. (tropical America further from Tonga to New Caledonia and Solomons), *Epistephium* Oreh. (S. America, New Caledonia), *Licania* Ros. (S. America, Loyalty, New Caledonia), *Lindenia* Rub. (Central America, Fiji, New Caledonia), and finally *Nicotiana* (Americas, Juan Fernandez, Marquesas, Tonga, New Caledonia, Loyalties, Lord Howe I., and Australia).

It is therefore impossible to include New Caledonia c. a. either in the Malaysian or in the Australian Province, and we conclude from this comparison that it should range as a province of its own.

This is in full agreement with the enormous development of endemic genera which is most surprising for the size of the island group, viz $102 = 15.4\%$.

This is of the same order as has been found in East Malaysia and in West Malaysia, but both these areas have an immensely larger surface and reach much higher altitudes.

It is still more surprising that the endemic genera are partly not at all monotypic, but often have large numbers of species, sometimes up to 50.

Others are of a very distinct relict type or of remote affinity, as for example *Canacomyrica* Myric., *Oceanopapaver* Papav., etc.

As to degree of endemic development only Hawaii and Juan Fernandez are more or less comparable.

There are distinct relationships with New Guinea as shown for example by *Dubouzetia*, *Antholoma* Elacoe., *Mooria* Myrt., and the taxonomically isolated *Sphenostemon* Aquif., but it should be added immediately that the latter genus has recently also been recorded from Queensland.

Similar relationships exist between New Caledonia and Australia, as shown for example by the distribution of *Canarium* sect. *Canariellum* Burs., *Callitris* Conif., *Argyrophyllum* Sax., and *Microsemma* Thym., which are confined to Australia and New Caledonia.

An interesting case is that of *Nothofagus* subsect. *Bipartitae* of which the living species are restricted to New Caledonia and New Guinea, but which is found (as Tertiary pollen) all over Australia.

There are a fair number of Pacific genera which are best developed in New Caledonia and the 8.2% of Pacific genera is as high as that for Australia and for Malaysia; 17 of them are not found in either Australia or Malaysia.

Further there are an astonishing number of genera which have a rich autochthonous speciation; they belong to several types, to mention a few examples: *Psychotria* Rub., *Phyllanthus* Euph., *Chrysophyllum* Sapot. of type 1, *Styphelia* Epaer. of type 6, *Bubbia* Wint. of type 5b, *Pittosporum* Pitt. of type 4.

Conclusion: All these aspects lead to one conclusion, viz that New Caledonia is a focus of specific and generic development deserving a status of its own in the West Pacific, with strong affinities to Australia, Malaysia, and the Pacific, that is, in all directions.

14. Tasmania

No generic spectrum of this island has been made, but I want to verify roughly in how far it is true that it should be included in the Australian floral province.

There are at least 367 autochthonous genera, according to the Flora by Rodway (1903) of which 342 also occur in Australia = 93.2% . The

endemism is still rather high, viz at least 13 genera = 3.5 %. A large number of genera are restricted to Tasmania and Australia.

I conclude therefore that Tasmania belongs to the Australian Province as a distinct subdivision.

15. New Zealand

34—47° S, 166—178° E; surface 265.000 sq.km; altitude 3750 m

Types	Number of genera	Percentage
Type 1	90	26.8 %
Type 1a	32	9.6 %
Type 2	12	3.6 %
Type 3	—	—
Type 4	21	6.2 %
Type 5	2	0.6 %
Type 5a	—	—
Type 5b	5	1.5 %
Type 6	50	14.9 %
Type 7	49	14.6 %
Type 7a	7	2.1 %
Type 7b	9	2.7 %
Type 8	23	6.8 %
Type 8a	31	9.2 %
Type 9	5	1.5 %
Total	336	100.1 %

Discussion: Although New Zealand is often not included in the Pacific Islands it must be taken up in this survey in order to fix its status.

Its generic spectrum shows a marked decrease in tropical genera which is in accordance with its latitude. Conversely there are a large number of temperate ones from types 1a, 2, 7—7b, in all 108 genera or 32.2 % of the total flora.

A remarkable feature is the occurrence of northern temperate genera which in the southern hemisphere are confined to New Zealand (some of these also in Australia). It is most likely that these genera have reached New Zealand through Malaysia-Australia — or have wandered vice versa — for example *Euphrasia* Scroph. (the area of which extends further to Tierra del Fuego and Juan Fernandez). Other examples are *Epilobium* Onagr. and *Potentilla* Ros., which are of the same type. The presence of some of these genera in the high mountains of Malaysia point in this direction.

In contrast to the hitherto considered island groups the Malaysian element is weak, viz 2.1 %. There are several genera which Malaysia has in common with New Zealand (in types 7 and 8), but most of these are foreign elements in Malaysia and of southern origin.

It is clear that the main affinity of the New Zealand genera is with Australia and Tasmania (type 6), c. 15 %.

New Zealand shares 271 genera or 80 % of the total with Australia and Tasmania. Of these 27 are restricted to Australia and/or Tasmania and New Zealand.

The next closest affinity is with temperate South America with which it has in common 176 genera = 52 %. In addition 8 genera are restricted to New Zealand and South America and do not occur in the Old World (mainly Australia and Tasmania).

A remarkable feature is the occurrence in New Zealand of some genera which are otherwise known mainly from South Africa (type 7a) and sometimes also from Australia, viz *Lobelia* sect. *Mezliera* Camp., *Sebaea* Gent., *Pelargonium* Geran., *Bulbinella* Lil., *Australina* Urtic., and *Cassinia*, *Helichysum* Comp. The endemic genus *Entelea* Til. belongs in this group as its closest allies are South African.

The number of endemic genera is fairly large, 31 genera = 9.2 %.

Conclusion: It may be stated that the generic spectrum and further considerations lead inevitably to refer the New Zealand flora to the Old World flora as a distinct Subprovince of the Australian Region.

15a. The subantarctic islands south of New Zealand

Incidentally a short survey is inserted on these islands in the New Zealand area. They show the following generic spectrum:

Auckland, Macquaries, Bounty, Antipodes, Campbell, and Chatham I.

43—55° S, 159° E to 176° W; surface 2300 sq.km; altitude 550 m

Types	Number of genera	Percentage
Type 1	23	22.8 %
Type 1a	19	18.8 %
Type 2	5	5.0 %
Type 3	—	—
Type 4	—	—
Type 5	—	—
Type 5a	—	—
Type 5b	1	1.0 %
Type 6	15	14.8 %
Type 7	23	22.8 %
Type 7a	3	3.0 %
Type 7b	7	6.9 %
Type 8	2	2.0 %
Type 8a	3	3.0 %
Type 9	—	—
Total	101	100.1 %

Discussion: As might be expected from their latitude the percentage of the subantarctic element (types 7—7b) is very high. The Malaysian element (type 5b) is only represented by *Corybas* Orch.

The endemic genera are *Myosotidium* Borr., *Pleurophyllum* Comp., and *Stilbocarpa* Aral.

Although most of the genera are also known from New Zealand the presence of three endemic genera induces us to give it the status of a District of the New Zealand Subprovince.

16. Lord Howe, Norfolk, and Kermadec Islands

16a. Lord Howe I.

32° S, 159° E;
surface 13 sq.km;
altitude 750 m

16b. Norfolk I.

20° S, 168° E;
surface 40 sq.km;
altitude 310 m

16c. Kermadec Group

29—32° S, 179° W;
surface 34 sq.km;
altitude 520 m

Types	Number of genera	Percentage	Number of genera	Percentage	Number of genera	Percentage
Type 1	54	43.0 %	40	38.5 %	30	47.7 %
Type 1a	5	4.0 %	5	4.8 %	6	9.5 %
Type 2	—	—	3	2.9 %	—	—
Type 3	—	—	—	—	—	—
Type 4	24	19.0 %	21	20.2 %	3	4.7 %
Type 5	—	—	2	1.9 %	—	—
Type 5a	—	—	—	—	—	—
Type 5b	4	3.2 %	3	2.9 %	1	1.6 %
Type 6	14	11.1 %	10	9.6 %	8	12.7 %
Type 7	7	5.5 %	7	6.7 %	6	9.5 %
Type 7a	1	0.8 %	—	—	—	—
Type 7b	5	4.0 %	3	2.9 %	5	7.9 %
Type 8	6	4.8 %	8	7.7 %	3	4.8 %
Type 8a	4	3.2 %	1	1.0 %	—	—
Type 9	2	1.6 %	1	1.0 %	1	1.6 %
Total	126	100.0 %	104	99.9 %	63	100.0 %

Discussion: The number of genera of these islands is of course small, but the percentages in the spectra agree rather well with those of New Zealand although the palaeotropical element (type 4) is stronger, except in Kermadec. The latter island group had better be subordinated under New Zealand; it has only 3 genera which do not occur in New Zealand and there are no endemic genera. The islands must all be assigned to the Australian Region on account of their large number of genera of type 6.

Pacific genera (type 8) are very few and are all of New Zealand origin.

Among the three groups *Lord Howe* has the best expressed individuality; though it is nearest to Australia (500 km), and is the smallest of the

three, it possesses 4 endemic genera (3 palms: *Howea*, *Hedyscepe*, and *Lepidorachis*, and *Negria* Gesn.). One genus is restricted to Lord Howe I. and New Zealand, viz *Carmichaelia* Leg. and further the endemic genus *Negria* Gesn. is allied to the New Zealand genus *Rhabdothermus*.

Lord Howe shares with Australia the genus *Westringia* Lab. and a section of *Dianella*, viz the group *Caerulea* Lil. Taking into consideration the much larger distance between Lord Howe and New Zealand than between it and Australia with its immensely rich stock of plants, the affinities with New Zealand become significant.

A peculiar phenomenon is the occurrence of *Moraea* Irid. which is otherwise only known from South Africa. A similar representation of the S. African element (type 7a) has been found in New Zealand.

Norfolk I. has far less individuality than Lord Howe I. and also less genera, but there is still one endemic genus, *Streblorrhiza* Leg. The spectrum of the types shows a great similarity to that of Rapa. See Survey 11e.

Kermadec is closely related to New Zealand; it has no endemic genera.

Conclusion: We may say that all three groups, and also Rapa, belong to the Australian Region, within which they show the greatest affinity to the New Zealand District. Kermadec belongs to the New Zealand Subdistrict, whereas Norfolk, Lord Howe, and Rapa form Subdistricts of their own.

17. Easter Island

27° S, 109° W; surface 117 sq.km; altitude 600 m

Types	Number of genera	Percentage
Type 1	16	61.5 %
Type 1a	6	23.0 %
Type 2	—	—
Type 3	—	—
Type 4	—	—
Type 5	—	—
Type 5a	—	—
Type 5b	—	—
Type 6	1	3.8 %
Type 7	—	—
Type 7a	—	—
Type 7b	2	7.7 %
Type 8	—	—
Type 8a	—	—
Type 9	1	3.8 %
Total	26	99.9 %

Discussion: The flora of Easter I. is so poor that its character is difficult to define. Probably the flora has been depauperated through the action of ancient inhabitants, and has in historic time still more been devastated by herbivores.

Against one American genus (*Axonopus* Gram.) also one Australian genus (*Dichelachne* Gram.) is found.

In order to make a more detailed analysis I have compared the affinities of the species within the genera. Of a number of these species nothing can be said in this respect, but of those which are positive the proportion is 10 allied to Asiatic or (mostly) Australian species and 4 to American species.

Conclusion: If it should be subordinated it should form an appendix to the Australian Province, classified here as a Subdistrict.

18. Juan Fernandez group

34° S, 79—81° W; surface 140 sq.km; altitude 1600 m

Types	Number of genera	Percentage
Type 1	25	27.8 %
Type 1a	13	14.4 %
Type 2	3	3.3 %
Type 3	—	—
Type 4	—	—
Type 5	—	—
Type 5a	—	—
Type 5b	—	—
Type 6	—	—
Type 7	10	11.1 %
Type 7a	—	—
Type 7b	5	5.6 %
Type 8	1	1.1 %
Type 8a	17	18.9 %
Type 9	16	17.8 %
Total	90	100.0 %

Discussion: The number of genera is not particularly large but of distinct interest owing to the extremely high percentage of endemic genera which give it a prominent degree of individuality.

Taxonomically these belong to the following families: *Borraginaceae* 1,

Bromeliaceae 1, *Compositae* 9, *Gramineae* 2, *Labiatae* 1, *Lactoridaceae* 1, *Myrtaceae* 1, *Palmae* 1. The family *Lactoridaceae*, consisting of a single species, is confined to this group.

Among the endemic genera there are 2 *Compositae*, viz *Robinsonia* and *Rhetinodendron*, which are closest allied to the Papuan genus *Brachionostylum*.

The strongest affinity is with South America, especially its antarctic portion.

There is a large proportion of subantarctic genera (types 7—7b), viz 16.7 %, all of which are also found in New Zealand. Among these, two genera do not occur in South America, viz *Haloragis* Halor. and *Coprosma* Rub., although the distance between the group and the mainland of America is only 600 km.

The single representative of group 8 is *Santalum* Sant., which does not occur in South America. This genus is particularly well developed in Hawaii.

It seems that the Juan Fernandez group is an old marginal refuge or exile of an ancient South Pacific flora, showing scattered remains of remote affinity. Through the generic spectrum it should floristically be subordinated to the South American Region.

19. San Ambrosio and San Felix (Desventuradas)

26° S, 80° W; surface 5 sq.km; altitude 400 m

Types	Number of genera	Percentage
Type 1	8	47.0 %
Type 1a	2	11.8 %
Type 2	—	—
Type 3	—	—
Type 4	—	—
Type 5	—	—
Type 5a	—	—
Type 5b	—	—
Type 6	—	—
Type 7	—	—
Type 7a	—	—
Type 7b	1	5.8 %
Type 8	—	—
Type 8a	3	17.7 %
Type 9	3	17.7 %
Total	17	100.0 %

Discussion: Against the situation found in Easter Island there are here 3 American genera (*Sicyos* Cuc., *Cristaria* Malv., *Plantago* sect. *Novorbis* Plant.) and no Pacific or Old World genera represented.

There are 3 endemic genera, which is quite surprising for such small islands, viz *Nesocaryum* Borr. (affinity pointing to tropical America), *Lycapsus* Comp. (no direct affinity), and *Thamnoseris* Comp. (probable affinity with *Dendroseris* of Juan Fernandez).

There are no wider dispersed Pacific genera represented (type 8).

Conclusion: Though small and poor, the flora of San Ambrosio should be subordinated to that of the South American Region. Its character approaches that of Juan Fernandez with which it could form one district.

20. Galápagos Islands

1° N—2° S, 89—93° W;
surface 5400 sq.km; altitude 1400 m

Types	Number of genera	Percentage	
Type 1	98	54.9 %	
Type 1a	2	1.1 %	<i>Apium</i> Umb., <i>Lycium</i> Sol.
Type 2	1	0.6 %	<i>Erigeron</i> Comp.
Type 3	—	—	
Type 4	1	0.6 %	<i>Chrysanthellum</i> Comp.
Type 5	1	0.6 %	<i>Odontochilus</i> Orch.
Type 5a	—	—	
Type 5b	—	—	
Type 6	—	—	
Type 7	1	0.6 %	<i>Pernettya</i> Eric.
Type 7a	—	—	
Type 7b	—	—	
Type 8	1	0.6 %	<i>Lipochaeta</i> Comp.
Type 8a	2	1.1 %	
Type 9	71	40.0 %	
Total	178	100.1 %	

Discussion: Though the Galápagos Islands are over 1000 km off the American coast the floristic spectrum indicates an extremely strong American element in their flora (type 9) amounting to 40 % of all the genera represented.

On the other hand the number of endemic genera is surprisingly low, namely only 2: *Scalesia* and *Lecocarpus*, both Comp.

In remarkable contrast with this stands the enormous number of endemic species of certain widely dispersed genera, for instance in the *Amaranthaceae*.

It is also remarkable that 5 types are not represented and five others only by one genus; the names of the genera have been mentioned in the spectrum.

Relations with the other Pacific islands are very weak, being only expressed in the occurrence of *Lipochaeta* Comp., which is obviously representative of the Hawaiian element in the flora.

Further there are a great number of the genera of type 1 which in the Pacific only occur in the Galápagos Islands.

There is a very sharp contrast between Galápagos on one side and all other Pacific islands on the other by the predominant tropical-American element. The only other island group where a high percentage of the American element is found is Juan Fernandez, but in the latter group this goes together with some other affinities (Subantarctic, Papuan, Pacific, etc.), which is not the case in the Galápagos.

Conclusion: The only conclusion can be that the flora of Galápagos is part of that of the Neotropical Region.

Summary

(1) The accompanying map illustrates the hierarchy of the floristic subdivision of the Malaysian-Pacific area and its demarcation against the New World flora. The way of linking it with the mainland of Eastern Asia has not been worked out. Further it has not been attempted to subdivide the Australian flora including Tasmania.

The following names are proposed:

Region	Province	Subprovince	District	Subdistrict
Indo-Malaysian	E. Asiatic			
	SE. Asiatic	W. Malaysian		
		S. Malaysian		
	Malaysian	E. Malaysian.....		E. Malaysian s.str. (incl. also Bismarcks)
				W. Carolines & Palau
				E. Carolines
				Marianas
				Solomons
		SW. Pacific		New Hebrides
				Fiji
				Samoa & Tonga
			 Central Pacific
			 SE. Polynesia
New Caledonian	Hawaiian			
Australian		Australia & Tasmania		
		New Zealand c.a.		New Zealand, incl. also Kermadec
				Chatham, Auckland, Antipodes, Campbell, Bounty and Macquaries
				Lord Howe I.
				Norfolk I.
				Rapa
			 Easter I.

(2) As has appeared from the surveys the number of endemic genera pro subdivision cannot be placed in any proportion to the surface of that subdivision; this appears for example from the following figures:

Name of area	maximum altitude in m	surface in sq.km	number of genera	endemic genera	percentage
Malaysia s.str.	5050	3,013,000	2178	c. 500	c. 23.0 %
Bonin	320	80	175	3	1.7 %
Marianas	400	640	217	1	0.5 %
West Carolines	240	600	345	1	0.3 %
East Carolines	790	700	235	1	0.4 %
Bismareks	2400	50,000	514	1	0.2 %
Solomons	2700	42,500	431	3	0.7 %
New Hebrides	1800	15,000	371	2	0.5 %
Fiji	1300	18,500	449	12	2.7 %
Samoa & Tonga	1820	4,500	357	2	0.6 %
Central Pacific	5	1,000	69	—	—
Southeast Polynesia ...	2200	c. 4,500	238	5	2.1 %
Hawaii	4100	15,000	238	43	18.1 %
New Caledonia & the Loyalties	1600	24,500	662	102	15.4 %
New Zealand & Kermadec I.	3750	265,000	339	31	9.1 %
Chatham, Auckland, Antipodes, Campbell, Bounty & Macqaries	550	2,300	101	3	3.0 %
Lord Howe I.	750	13	126	4	3.2 %
Norfolk I.	310	40	104	1	1.0 %
Rapa	660	40	95	1	1.0 %
Easter I.	600	117	26	—	—
San Ambrosio	400	5	17	3	17.7 %
Juan Fernandez	1600	140	90	17	18.9 %
Galapagos	1400	5,400	178	2	1.1 %

(3) If two islands are comparable ecologically (latitude, altitude, climate, soils) and are at comparable distance from a continental flora or other big plant source, the island with the smallest surface has the largest percentage of world-wide genera (type 1). This appears from a comparison of Samoa (43 %) with Tonga (50 %), and Tonga with Cook I. (61.6 %).

(4) The highest percentage of worldwides is found in the coral islets and atolls.

(5) For ecologically more or less comparable islands the rule seems to be that the distance to a continental flora or other rich plant source and the total number of genera are inversely proportional. For example

Lord Howe I. (surface 13 sq.km) at a distance of 500 km from Australia has 126 genera and Norfolk I. (surface 40 sq.km) at a distance of 1600 km from Australia has only 103 genera, even though it is thrice as large as Lord Howe I.

(6) Generic endemism and specific endemism often do not go parallel. The Galápagos, Marquesas, New Hebrides, and Rapa I. have a high specific endemism, but possess very few endemic genera.

(7) a. In the Pacific the Malaysian influence reaches in general wide and far.

b. The Australian influence in the Pacific is proportionally small and affects mostly the southern Pacific.

c. The influence of the American flora is surprisingly small, even in islands which are situated relatively very close to the New World if compared with their distance to the Old World, for example the Marquesas, Easter I., etc.

d. If the South American element is found far in the Pacific it is almost restricted to the subantarctic part of it.

(8) The method of the demarcation knots is only useful if islands or island groups are contrasted which have a comparably rich flora, containing a number of genera of about the same order, for example Formosa and the Philippines, Malaysia and Australia, the Solomons and the New Hebrides (the latter with respectively 431 and 371 genera: demarcation 60 %).

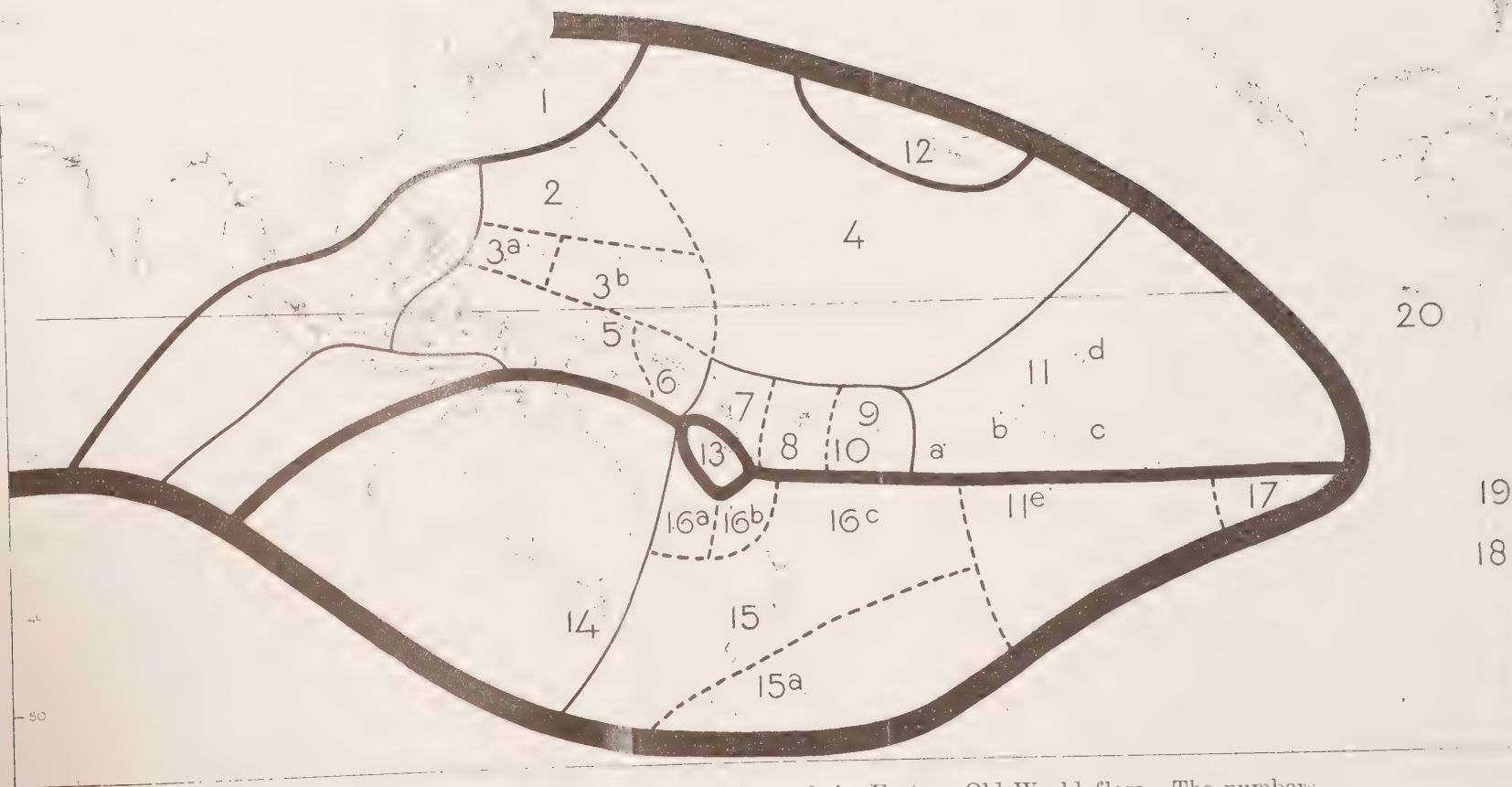
If the areas are very dissimilar in number of genera the method of demarcation knots will result in a wrong picture of the situation.

In the latter case the approach for the estimate should be made in another way, for example by focussing attention to the number of genera which occur in the poorest of the pair and not in the richest.

An illustrative example of this is a comparison between New Caledonia and the Loyalty Islands, where the demarcation knot would be 61 % on account of the very high number of New Caledonian genera which do not occur in the Loyalties. Actually, only 2 genera occur in the Loyalties which have not been recorded from New Caledonia, showing that the Loyalty Islands flora is merely a depauperated New Caledonian one.

References

- BROWN, F. B. H., 1935. Flora of Southeastern Polynesia. Bull. Bern. P. Bishop Mus. 130: 6.
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Map 1. Delimitation and subdivisions of the Eastern Old World flora. The numbers (and subordinated letters) merely refer to the sequence of the areas and subareas as treated in the text.

The relative thickness of the lines refers to the floristic, plant-geographic hierarchy of the Regions, Provinces, Subprovinces, and Districts, in that sequence, as distinguished and tabulated in the summary.

ZUR KENNTNIS VON GNETUM NEGLECTUM BL.

VON

F. MARKGRAF

(Zürich)

Gnetum neglectum war nicht nur, wie der Name andeutet, bis zu Blumes Zeit übersehen worden, sondern es wurde von Späteren wiederum verkannt, wie ich in Bull. J. B. Buitenzorg 3. Ser. 10 (1930) 474 näher ausgeführt habe. Die echte Art taucht verhältnismässig selten in den Herbarien auf. Sie ist eine Pflanze der Alluvialwälder in Borneo. Vegetativ ist sie ausgezeichnet durch derbe, grosse, lanzettlich-elliptische Blätter mit Träufelspitze, deren Seitennerven auffallend weit voneinander abstehen. Die Blütenstandsachsen sind ziemlich zart und wenig verzweigt, die Samen klein, ungestielt und etwas gelblich.

Merkwürdigerweise war in den reichen Sammlungen aus Borneo, die mir bisher zu Gesicht kamen, diese Art immer nur durch ♀ Pflanzen vertreten. Jetzt sind zum ersten Mal auch ♂ Exemplare zum Vorschein gekommen, und zwar im Herbarium Sarawak. Sie sind repräsentiert durch eine neuere Sammlung des Forest Department Herbarium Brunei, Smythies, Wood & Ashton, Flora of Brunei, Nr. S. 5752, gesammelt am 25. 3. 1957 am Ufer des Flusses Belalong im Primärwald in 250 Fuss Meereshöhe, und durch eine ältere Sammlung aus Kuching, Nr. 202 des Sarawak Museums. Durch die oben angegebenen Merkmale der Blätter und des Aufbaus der Blütenstände erwiesen sich die Exemplare deutlich als zu dieser Art gehörig, und die männlichen Kätzchen haben durchaus einen eigenen Charakter, der von anderen Arten abweicht.

Im Folgenden sei daher die Kenntnis der Art durch die Beschreibung der ♂ Blütenstände ergänzt:

Inflorescentiae masculinae saepe cauliflorae, semel ramificatae; rami graciles (1 mm crassi), 2—4 longi; amenta 3 mm crassa, 3—5 cm longa. Colla cylindrico-infundibuliformia, 3 mm alta. Flores feminei steriles pauci (4—6), ellipsoidei, breviter acuti, 1½ mm longi; involucrum chartaceum, ovulum oblique ovoideum, sensim acuminatum, 1 mm altum. Flores masculini numerosi, obconici, 2 mm alti; stamen unicum biloculare, loculis albidis, in vertice fissis.

REVISION OF THE SAPOTACEAE OF THE MALAYSIAN AREA IN A WIDER SENSE

XXIII¹⁾. *Palaquium* Blanco

by

P. VAN ROYEN

(Rijksherbarium, Leiden)

(Issued on I. XII. 1960)

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Introduction

This study includes the entire genus *Palaquium* since in the 35 years after the publication of the work of H. J. Lam on the Sapotaceae much new material has come to our disposal to broaden the knowledge of the genus.

The results of the study could not have been obtained without the assistance of the Directors of the following herbaria who put their material available on loan: Berkeley (U. S. A.), Berlin, Brisbane, Bogor, Florence, Cambridge (U. S. A.), Geneva, Kepong, Kew, Kuching, Lae, Leiden, London, Melbourne, Oxford, Paris, Sandakan, Stockholm, Sydney and Washington, to whom I express my most sincere thanks.

The abbreviations of the names of these herbaria are those proposed by Lanjouw and Stafleu in the Index Herbariorum. For the herbarium

¹⁾ I—III in *Blumea* VI, 1952, 547—595; IV—V in *Blumea* VII, 1953, 364—412; IVa in *Blumea* VII, 1954, 481—483; IIa, IVb, Va, VI—IX in *Blumea* VIII, 1957, 201—509; X—XII in *Nova Guinea* NS 8, 1957, 87—128; XIII—XVI in *Blumea* IX, 1958, 21—152; XVII in *Blumea*, Suppl. IV, 1958, 263—267; IIb, IXa, XVIII, XIX in *Nova Guinea* NS 9, 1959, 131—142; XX—XXII in *Blumea* X, 1960, 1—125; XXIII in the present issue.

of the Forest Department in Manokwari the old abbreviation HOLL is still used.

The sizes of the drawings are given in millimeters.

GENERAL PART

Diagnosis of the genus

Palaquium Blanco, Fl. Fil., ed. 1, 1837, 403; ed. 2, 1845, 282; Burek, Ann. Jard. bot. Bzg 5, 1886, 22; Engler, Bot. Jahrb. 12, 1890, 511; Boerlage, Handl. Fl. Ned.-Indie 2, 1, 1891, 302; Baillon, Hist. Pl. 9, 1891, 301; Engler & Prantl, Nat. Pfl. fam. 4, 1, 1897, 126 and Nachtr., 1897, 273; King & Gamble, Journ. As. Soc. Beng. 74, 2, Extra Nr 17, 1905, 189; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16; Dubard, Bull. Mus. hist. nat. 15, 1909, 379; Lam, Bull. Jard. bot. Bzg 3, 7, 1925, 14; Lam, Bull. Jard. bot. Bzg 3, 8, 1927, 384; Lam, Nova Guinea 14, 4, 1932, 551, f. 94—98; Lam, Blumea 5, 1, 1942, 31, f. 6—7 — *Isonandra* Wight, Ic. Pl. 2 1842, t. 359—360, p.p.; Miquel, Fl. Ind. Bat. 2, 1859, 1037 — *Dichopsis* Thwaites, Enum. Pl. Zeyl., 1864, 176; Bentham & Hooker, Gen. Pl. 2, 2, 1876, 658; Clarke in Hooker fil., Fl. Br. Ind. 3, 1882, 540 — *Croixia* Pierre, Not. bot. Sapot., 1890, 33, p.p. — *Galactoxylon* Pierre, Not. bot. Sapot., 1890, 6; Baillon, Hist. Pl. 9, 1891, 300; Engler & Prantl, Nat. Pfl. fam. 4, 1, Nachtr., 1897, 272.

Laticiferous trees. Branchlets with distinctly developed terminal cones or these replaced by a terminal inflorescence. Stipules small to very large, usually soon caducous, rarely persisting and ultimately caducous, very rarely entirely absent. Leaves scattered, petiolate, secondary nerves joined by tertiary nerves except when the latter are parallel to the secondary nerves, sometimes the secondary nerves archingly joined. Flowers 3-merous, very rarely not so, solitary or in clusters, axillary to the leaves or their scars, sometimes in a short inflorescence at apex of branchlets, with distinct bracts at base of pedicel. Sepals in two whorls of three, very rarely in two whorls of 2, or 5 or 7 spirally arranged sepals and imbricate. Corolla gamopetalous, 6-, rarely 4- or 5-lobed, imbricate or often contort. Stamens (8—)12—18(—36) in one, two or three whorls inserted in the throat, anthers with prolonged connective. Ovary (5—)6(—11)-celled, each cell with one usually pendulous, anatropous ovule. Style 1. Fruit a berry, with fleshy pericarp, 1—3-seeded. Seeds with a large scar which often covers half the surface, very rarely narrow or larger, hilum apical, testa crustaceous to coriaceous, embryo usually without endosperm, sometimes with a thin layer only.

Type species. *P. lanceolatum* Blanco.

Distribution. About 115 species, but probably more, in southeast Asia, Malaysia and the Pacific islands.

Abbreviations of some references

- Lam, l. c. 1925 = H. J. Lam, The Sapotaceae etc. of the Dutch East Indies, Bull. Jard. bot. Bzg, sér. 3, 7, 1925, 14—107.
 Lam, l. c. 1927 = H. J. Lam, Further Studies, etc., Bull. Jard. bot. Bzg, sér. 3, 8, 1927, 384—414.

Lam, l. c. 1932 = H. J. Lam, Sapotaceae, Nova Guinea 14, 4, 1932, 551—553.

Lam, l. c. 1942 = H. J. Lam, Wild Pacific Sapotaceae etc., Blumea 5, 1, 1942, 31—36.

Subdivision of the genus

The last division of *Palaquium* into smaller units is that given by Lam in 1925 where he divides the genus into three sections, viz *Eupalaquium* Dubard to which most species belong, a section *Palaquioides* Dubard, and a section *Galactoxylon* H. J. Lam. Studying this last section it appears that only *P. edenii* is included and not, as one would expect, *Palaquium galactoxylon* (based on *Galactoxylon* sp. Pierre, a synonym of *Bassia galactoxylon* F. Mueller), which is merely mentioned under the heading "extra-malayan species". This is the more deplorable since Pierre's addition to von Mueller's description does not make it easy to insert *Galactoxylon* in *Palaquium*. Basing oneself on Pierre's emendated diagnosis one would rather keep *Galactoxylon* apart from *Palaquium*. Studying von Mueller's material it appeared that specimens matching it exist in material collected in New Guinea and the Solomons and described by White as *P. salomonense*, which, however, differs consistently from *P. galactoxylon* only in the longer petioles. When flowers of this material are studied there is no doubt that a species of *Palaquium* is at hand and that Pierre's description of the flower is based on entirely different material, which unfortunately could not be retraced. The details of the flowers point to a species belonging to the section *Eupalaquioides* and therefore the necessity to maintain the section *Galactoxylon* does not exist any longer.

On examining the material of *P. edenii* it becomes immediately clear that the characteristics of this species do not warrant the maintaining of a separate section in *Palaquium* owing to its close similarity to e. g. *P. dasysphyllum*, *P. lisophyllum*, *P. macrocarpum* etc., all of which were included by Lam in the section *Eupalaquioides*.

When the genus is studied as regards the group of related species it is striking that the basic leaf-shape is obovate. From this several trends can be distinguished, viz a group with spatulate leaves and a group with elliptic to lanceolate leaves. This combined with the sizes of the leaves, the type of tertiary nervation etc. gives us the possibility to distinguish seven main groups. As is found in *Planchonella*, *Pouteria*, and *Madhuca* there is no sharp distinction between the groups owing to the reticulate relationships.

Group 1

Species 1—4. Found in the entire area.

In a group with transverse tertiary nerves the true obovate leaves are represented by a number of species, viz *P. obovatum*, *P. grande*, *P. oxy-spermum*, and *P. stehlinii* of which the latter three sometimes have elliptic-obovate leaves and form an intermediate group to a group of 11 species with elliptic or elliptic-obovate leaves which are glabrous or subglabrous below. Among these are *P. hexandrum* and *P. ridleyi*, but this group will be discussed below.

Group 2

Species 5—32. Found in the entire area.

Immediately related to the *P. obovatum*-group is a group of 28 species all with obovate leaves, to be divided into four series, which are, however, not sharply delimited against each other owing to intermediate forms:

- a. obovate leaves, underside pubescent, leafbase rounded, with 10 species, viz *P. abundantiflorum*, *P. beccarianum*, *P. clarkeanum*, *P. elegans*, *P. hispidum*, *P. majas*, *P. montanum*, *P. philippense*, *P. sericeum* and *P. sorsogonense*.
- b. obovate leaves, underside glabrous, leafbase rounded, with 4 species, viz *P. erythrospermum*, *P. fidjiense*, *P. formosanum* and *P. rivulare*.
- c. obovate leaves, underside glabrous, leafbase acute, with 4 species, viz *P. cuprifolium*, *P. gigantifolium*, *P. globosum* and *P. kinabaluense*.
- d. obovate leaves, underside pubescent, leafbase acute, with 10 species, viz *P. barnesii*, *P. decurrens*, *P. eriocalyx*, *P. komakomar*, *P. maingayi*, *P. ottolanderi*, *P. pinnatinervium*, *P. polyandrum*, *P. stipulare*, *P. supfianum*.

About these four series the following can be said.

Series a. Of the species mentioned three are slightly different in their leaves, viz *P. beccarianum* on the one hand and *P. elegans* and *P. sericeum* on the other. *P. beccarianum* is aberrant because of the archingly joined secondary nerves but otherwise much resembles *P. hispidum*. *P. elegans* and *P. sericeum* are different since the leaves are more panduriform than obovate and the apex is rather long acutely acuminate, in contrast with the others which have either rounded, obtuse or short obtusely, or acutely acuminate apices. The number of stamens in this group is in general 12, though *P. beccarianum* has 10—12 and *P. clarkeanum* 12—15. *P. majas* and *P. sorsogonense* have 18 stamens but *P. philippense* has 12—18 stamens. A separation into different groups on account of the number of stamens is therefore not easily feasible.

Series b. The species of this series also have 12(—14) stamens but an exception is *P. rivulare* with 18—21 stamens. Also in other respects this species is aberrant since its leaves are more panduriform than obovate and compared with the other species they are larger. *P. fidjiense* is intermediate to series c. since the leaves, especially the midrib is either glabrous or sparsely pubescent.

Series c. This small group of species is composed of four species with large leaves but are more striking by the large number of stamens (18—24) in *P. gigantifolium* and *P. globosum* correlated with large stipules (over 2 cm long), while *P. kinabaluense* is aberrant by having only 12 stamens and small stipules. The flowers of *P. cuprifolium* are unknown but here also the stipules are small.

Series d. This large series falls apart into two subseries since *P. decurrens* and *P. stipulare* differ from the other eight by having a sericeous pubescence on the underside of the leaves while the others have a more woolly or tomentose pubescence. Moreover *P. stipulare* has large stipules correlated with a large number of stamens (22—27).

Among the other 8 species *P. pinnatinervium* and *P. polyandrum* differ from the rest by having a panduriform leaf in the former, together with long stipules, and *P. polyandrum* by having also relatively long stipules (0.9—1.2 cm) again correlated with a large number of stamens (24—33). The number of stamens of *P. polyanthum* is unknown.

The remaining 6 species have close affinities to a group of 5 species characterized by i. a. *P. gutta*, *P. calophyllum* and *P. quercifolium* (see below).

Group 3

Species 33—37. Malaya, Borneo, Philippines.

A small group of rather similar species with small, obovate leaves but distinctly different from group 2 and actually more related to group 4 is formed by *P. crassifolium*, *P. elliptilimbum*, *P. herveyi*, *P. multiflorum*, and *P. walsurifolium*. This small group is connected with the genus *Isonandra* by *P. crassifolium* and *P. multiflorum* because of the variable number of sepals (4—7 here, 4 in *Isonandra*) and small number of stamens (9—13 here, 8 in *Isonandra*). At the same time this group is connected with group 4 by *P. cryptocariifolium* in group 4.

Group 4

Species 38—48. Ceylon to New Guinea.

This group comprises 11 species among which *P. ridleyi*, *P. hexandrum*, and *P. macrocarpum*. Other species are *P. cryptocariifolium*, *P. dasyphyllum*, *P. edonii*, *P. laevifolium*, *P. lisophyllum*, *P. petiolare*, *P. pierrei* and *P. verilatatum*. The entire group is characterized by 9—12 stamens and elliptic leaves which often are thin and glossy, and glabrous to subglabrous. *P. macrocarpum* connects this group with the *obovatum*-group (1) by its obovate leaves, while *P. hexandrum* links this group with group 3 by way of *P. herveyi*. *P. ridleyi* connects this group with the group of species with reticulate tertiary nervation. All species of this group are mutually related and a subdivision is difficult to be carried out.

Group 5

Species 50, 52—55. Malaya to Solomons.

This group is composed of 5 species with spatulate leaves and is a direct intermediate to the group of species with a reticulate nervation. The species included are *P. burckii*, *P. firmum*, *P. leiocarpum*, *P. obtusifolium*, and *P. oxleyanum*. Of these *P. burckii* has 20—25 stamens and is at the same time the species most related in its foliar details to *P. rigidum*, *P. sumatranum*, and *P. rostratum* of group 8. All other species in group 5 have 12 stamens except *P. obtusifolium* with 12—18 stamens, while in *P. firmum* this number is unknown. On the other hand this group is connected to group 6 (a. o. *P. rioense*, *P. lobbianum*, etc.) by the shape of the leaf and the tertiary nervation.

Group 6

Species 51, 56—85. Entire area from Malaya, Siam and Indo-China eastward.

This large group of 31 species has a series of 19 species and three smaller series of 3, 5 and 4 species respectively. The species are in the main characterized either by elliptic or elliptic-obovate leaves.

The first series can be divided into two subseries, both with leaves varying in shape from elliptic-obovate to narrowly elliptic, and based on the pubescence of the underside of the leaves.

a. pubescent underside

P. warburgianum

P. loheri

P. luzoniense

P. bataanense

P. neo-ebudicum

P. rioense

P. lobbianum

P. pseudocalophyllum

P. maliliense

b. glabrous underside

P. morobense

P. mindanaense

P. tenuipetiolatum

P. foxworthyi

P. glabrum

P. lanceolatum

P. garrettii

P. stellatum

P. merrillii

P. simun

The number of stamens in the first subseries is 9—14, that of the second subseries 9—18 and is of no use for a further division. In general the species are very closely related and often hard to separate in a sterile state. *P. lobbianum* and *P. pseudocalophyllum* in the first subseries and *P. lanceolatum* and *P. merrillii* in the second subseries connect this group to the second series of five species comprising *P. calophyllum*, *P. ferrugineum*, *P. gutta*, *P. quercifolium*, and *P. tjiptirensense*, to be separated from the main body by the often golden-sericeous pubescence of the underside of the leaves, those of the first 18 being in general more tomentose. The third section of 3 species is formed by *P. cochleariifolium*, *P. hornei*, and *P. karrak*, three rather similar species with large flowers all conferted near the tip of the branchlets, elongate-obovate leaves, a small number of secondary nerves and hardly visible tertiary nervation. *P. cochleariifolium*, though having larger leaves, resembles in some respects (inconspicuous tertiary nerves and thick, leathery leaves) *P. ridleyi*, thus linking up group 6 with group 4.

The fourth series consists of 4 small-leaved, narrowly obovate-elliptic leaves which are closely related to e.g. *P. maliliense*, *P. luzoniense*, *P. bataanense*, etc. and might as well be inserted in the main group except for their small leaves. They comprise *P. confertum*, *P. elongatum*, *P. koratense*, and *P. vitilevuense*.

Group 7

Species 49, 86—109. Entire area.

This group consists of 24 species, all characterized by a reticulate tertiary nervation, sometimes with a few, irregular transverse nerves. Most of the species have obovate leaves but also spatulate or elliptic ones are known, with all intermediate stages.

The two main series in this group are a group with:

- a. tertiary nerves reticulate with a few irregular transverse nerves mainly near the margin of the leaf,
- b. tertiary nerves reticulate-elongate, parallel to the secondary nerves of the leaf.

The first series is restricted to continental Asia and has generally large leaves, often with an irregular intramarginal nerve. The flowers are among the largest of the whole genus. This series is composed by the following species: *P. bourdillonii*, *P. canaliculatum*, *P. ellipticum*, *P. hin-molpedda*, *P. pauciflorum*, *P. polyanthum*, *P. rubiginosum*, *P. sukoei*, and *P. thwaitesii*. In this series the same two trends — obovate or elliptic leaves — as found in all other groups are observable as well, but here also the distinction is not a sharp one. The number of stamens is usually 12, sometimes 15 (*P. polyanthum*) or 18 (*P. ellipticum*). This series is connected with group 4 (*P. ridleyi*, *P. laevifolium*) by *P. hin-molpedda* and *P. sukoei* on the one hand, by *P. thwaitesii* on the other hand. The other species of this series are related to group 5 and 6 in different ways. To group 5 it is related by way of *P. obtusifolium* and by way of e.g. *P. pseudocalophyllum*, *P. lobbianum*, and *P. garrettii* it is related to group 6.

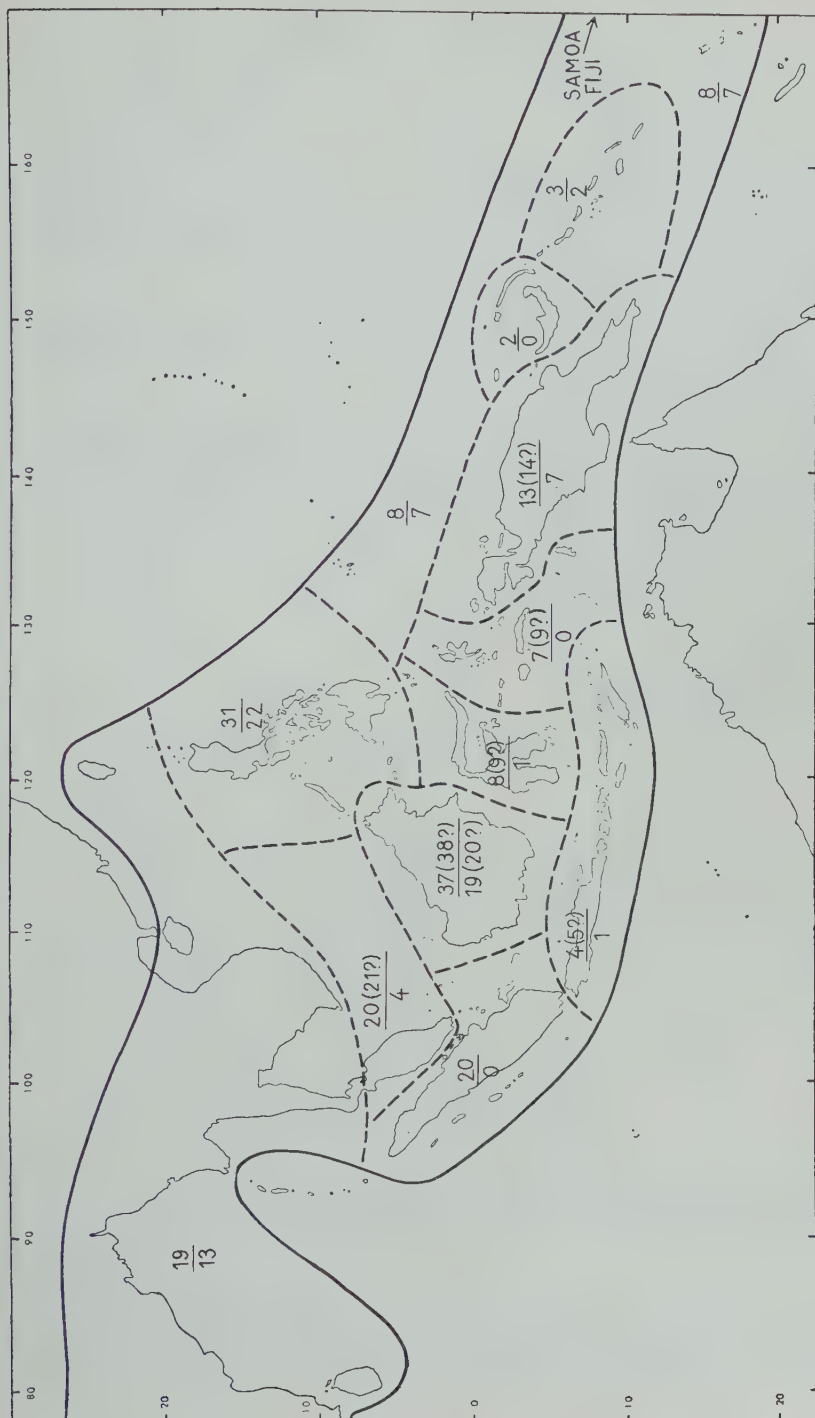
In the second series which includes the remainder of the genus, *P. xanthochymum* is an intermediate species towards group 5; it is especially related to *P. obtusifolium*. The tertiary nervation often has quite a number of transverse nerves, but sometimes hardly any one is present. For this reason this species is inserted here but with as much good reason it could be inserted in group 5. Since its relationship to other species (e.g. *P. sumatranum*, *P. semaram* etc.) in this second series it is placed in group 7. Closely related to *P. xanthochymum* are three species, viz *P. semaram*, *P. galactoxylum*, *P. brassii*, in which an occasional transverse tertiary nerve is still present, but in the sequence given these are found less and less. The number of stamens in this group of four is in all cases 12.

Three more species in the second series can be placed together since they differ by the large leaves from the other species, viz *P. rigidum*, *P. rostratum* and *P. sumatranum*, which form a link to group 5 by way of *P. burckii*. The tertiary nervation is reticulate and subparallel to the secondary nerves. The number of stamens is always 12.

Finally a subseries of 8 species all of them with small, obovate leaves (under 15 cm long) forms the body of the second series. The tertiary nervation is reticulate and subparallel or parallel to the secondary nerves. Two distinct lines can be distinguished in this final series, viz one in which the tertiary nervation is rather sparse and often inconspicuous and comprises *P. cuneifolium*, *P. dubardii*, *P. glabrifolium* and *P. microphyllum*. The second line comprises *P. amboinense*, *P. pseudocuneatum*, *P. rostratum* and *P. rufolanigerum* in which the tertiary nervation is rather dense and always distinct. The number of stamens is in both series 12, but in *P. pseudocuneatum* it is sometimes reduced to 8.

Distribution (Map 1)

The distributional pattern of *Palaquium* clearly shows that this genus is a western Malaysian one with its main centre in Borneo and the Philippines.



Map 1. Distribution of the genus *Palaquium*. Numbers above the bar indicate the number of species, those under it that of the endemics. Neither the western nor the eastern limit has been considered.

With these two areas as the main centre, in which also the highest number of endemics is found, New Guinea should be considered as an important secondary centre though the number of species is about a third of that of Borneo or the Philippines, but the number of endemics appears proportionately to be the same or slightly lower. From these centres the number of species decrease rather quickly.

Surprisingly enough continental Asia with 19 species only has 13 endemic species. The importance of this fact is misleading since 19 species are scattered over an area almost as large as the rest of the area in which Palaquium is found and in which 91 species are known.

Though the Malay Peninsula and Sumatra both have 20 species the number of endemics is very low, 20 % for the peninsula and 0 % for Sumatra, compared with c. 50 % for Borneo, c. 65 % for the Philippines and c. 55 % for New Guinea.

The sharp decrease in number from the centres towards the periphery of the area as observed in *Madhuca* is less marked in *Palaquium*, especially towards the eastern areas. *Madhuca* reaches not further than New Guinea but some *Palaquium* species penetrate deeply into the Pacific area. To the west both genera reach almost the same limits, viz the western states of India.

In the table given below these points are given in more detail:

	number of species	endemics
Continental Asia	19	13
(India, Burma, Ceylon, Siam, Indo-China, Formosa)		
Malay Peninsula	23 (24 ?)	6
Sumatra	17	0
Java	6	1
Borneo	37 (38 ?)	21 (20 ?)
Philippines	32	23 (22 ?)
Celebes	8 (10 ?)	1
Moluccas	9 (11 ?)	0
New Guinea	12 (13 ?)	7 (6 ?)
Pacific Islands	8	7
New Britain	2	0
Solomons	3	2

TAXONOMIC PART

Key to the species *)

- 1.a. The terminal cone of the branchlets replaced by flowers or an inflorescence 2
- b. Branchlets provided with a distinct terminal cone 3
- 2.a. Sepals acute or subacute, tomentose on outside. Corolla entirely glabrous. Fruits obovoid, 12—14 by c. 7 mm. *Indo-China, Malaya to Sumatra, Philippines and New Guinea* 48. *P. ridleyi*

*) The following species are not included on account of the incomplete material: D. 1. *P. ? annamense*, D. 2. *P. ? densivenium*, 55. *P. firmum*, 100. *P. glabrifolium*, 4. *P. oxyspermum*, D. 3. *P. ? payenifolium* Pierre, D. 4. *P. ? retusum* Beccari, D. 5. *P. ? tenuifolium*, and D. 6. *P. ? vidalii* Pierre.

- b. Sepals obtuse, woolly on outside. Corolla-lobes fimbriate at apex and with a few hairs in the middle-line of each lobe. Fruits ellipsoid, c. 10 by 7 mm, *Borneo*
46. *P. cryptocariifolium*
- 3.a. Stipules 2—6 by 0.8—1.4 cm 4
b. *) Stipules 0.1—1.8 by 0.1—0.6 cm, or none 5
- 4.a. Stipules up to 6 by 1.2 cm. Leaves glabrous on either side, obovate, obovate-elliptic or oblanceolate, apex obtuse, acute or acuminate, base broadly subrotundate. Petioles 3.5—5 cm long, glabrous. Pedicels in fruit up to 1.8 cm long. *Philippines* 20. *P. gigantifolium*
b. Stipules 2—3.5 by 0.8—1.4 cm. Leaves densely puberulous below, pandurate, sometimes obovate-oblong, apex retuse, rounded or obtuse, base broadly cuneate. Petioles 1—2.5 cm long, tomentose. Pedicels in fruit 3—5 cm long. *Philippines*
30. *P. pinnatinervium*
- 5.a. Stamens (20—)22—24(—34). Ovary 8—14-celled 6
b. Stamens 8—18(—25). Ovary 6-, rarely 4-, 5- or 7-celled 8
- 6.a. Leaves yellowish brown tomentose below. Petioles cinnamomously tomentose. Ovary cinnamomously pubescent, 8—12-celled. Stamens 22—27, filaments and anthers pubescent. *Borneo* 32. *P. stipulare*
b. Leaves glabrous below, sometimes slightly tomentose. Petioles glabrous. Stamens 20—34, filaments pubescent or glabrous, anthers glabrous. Ovary glabrous 7
- 7.a. **) Fruits globose, 3.5—4 by c. 3.5 cm. Stipules oblong-ovate or squamiform, 1—3.5 by 0.8—2 cm. Corolla about twice as long as calyx, 1—1.2 cm long. Filaments of stamens ferruginously puberulous, anthers glabrous. *Philippines*
21. *P. globosum*
b. **) Fruits ellipsoid or ovoid, 2—2.2 by c. 1.9 cm. Stipules ovate-lanceolate, 0.9—1.2 by 0.3—0.4 cm. Corolla about 3—4 times as long as calyx, 1.5—1.9 cm long. Filaments of stamens glabrous, anthers glabrous. *Philippines*
28. *P. polyandrum*
- 8.a. Tertiary nerves reticulate-parallel to the secondary nerves ***) 9
b. Tertiary nerves transverse or absent 31
- 9.a. Anthers glabrous 10
b. Anthers pubescent, sometimes sparsely so 28
- 10.a. Sepals glabrous on inside 11
b. Sepals pubescent on inside 24
- 11.a. Corolla glabrous on either side 12
b. Corolla pubescent on one or either side, sometimes only partly so 17
- 12.a. Midrib dark reddish woolly below, leaves otherwise glabrous, the latter spatulate, obovate-oblong or rarely linear-lanceolate, 9—13.5(—19) by 3—6(—8) cm, rotundate to obtusely acuminate, secondary nerves 18—25 pairs, irregularly archingly joined, at base and apex of leaf hardly distinguishable from the tertiary nerves. *Malaya, Sumatra, Lingga* 99. *P. semaram*
b. Midrib either glabrous or tomentose below 13
- 13.a. Ovary glabrous. Leaves often coppery reddish when dry, obovate, elliptic, lanceolate or spatulate, 6—20 by 2.2—6 cm, retuse, rounded, obtuse or obtusely acuminate at apex, narrowly cuneate to subrotundate at base, midrib minutely crested, secondary nerves 12—16(—20) pairs, tertiary nerves usually transverse, rarely subreticulate-parallel. Petioles 7—11(—32) mm long. Pedicels (1.5—) 3—9 mm long. *Malaya, Sumatra, Riouw, Lingga, Banka, Java, Borneo*
96. *P. xanthochymum*
b. Ovary pubescent. Leaves dark brown, light brown, greenish or reddish when dry, tertiary nerves reticulate-parallel, never transverse 14
- 14.a. Flowers almost sessile, pedicel 1—2 mm long, ferruginously tomentose. Leaves

*) The stipules in 98. *P. rufo-lanigerum* and 29. *P. komakomar* are unknown but both species are included under b.

**) Cf also 22. *P. euprifolium*.

***) Under this item also 91. *P. canaliculatum* (Thw.) Engler and 95. *P. thwaitesii* Trimen from Ceylon, of which no complete flowers are known.

- ovate-elliptic, elliptic, or obovate-elliptic, 12—24 by 3.5—7.5 cm, long obtusely acuminate at apex, narrowly cuneate at base, secondary nerves 11—16 pairs, midrib grooved above, petioles 1—2.6 cm long. *Ceylon*. **89. P. pauciflorum**
- b. Pedicels 3—12 mm long. Petioles 9/10—6 times as long as pedicels. 15
- 15.a. Pedicels (6—12 mm) as long as petioles (6—13 mm). Leaves obovate-spathulate to obovate-orbicular, (3—)5—8(—12) by (1.5—)2—3.5(—5) cm, rounded or short obtusely acuminate, sometimes cordate at apex, narrowly cuneate at base, secondary nerves (7—)8—11(—15) pairs, midrib narrowly crested usually in the basal part only. *Philippines*. **103. P. cuneifolium**
- b. Pedicels much shorter than petioles, the former (1.5—)5—10(—12) mm, the latter (0.7—)1.6—4.5(—6.5) cm long. Secondary nerves (9—)16—26(—33) pairs. Midrib of leaves at upper side grooved only. 16
- 16.a. Stipules 1—2 mm long. Underside of leaves densely tomentose or sericeous, sometimes ultimately glabrous. Ovary ovoid. *Malaya, Sumatra, Borneo and surrounding islands, cultivated elsewhere*. **81. P. gutta**
- b. Stipules 5—6 mm long. Underside of leaves glabrous. Ovary disciform. *Siam, Sumatra, Riouw, Borneo, Billiton, Java*. **109. P. sumatranum**
- 17.a. Petioles much longer than pedicels of flowers in the axil of the leaf under observation. 18
- b. Petioles and pedicels almost equal in length or pedicels longer than petioles. 21
- 18.a. Filaments of stamens pubescent. Leaves obovate, spathulate or elliptic, (5—)7—22 by 2.5—7(—9) cm, retuse, rounded, obtuse, short obtusely acuminate or obtusely cuspidate at apex, narrowly cuneate at base, secondary nerves 15—28 pairs, ascending at an angle of 70°—90°, irregularly joined. Corolla reflexed in anthesis. *Malaya to Amboina and Java*. **90. P. rostratum**
- b. Filaments of stamens glabrous. 19
- 19.a. Corolla glabrous on one side. 20
- b. Corolla ferruginously sericeous on outside in middle-line of lobes and on the tube, densely woolly tomentose in the throat. Leaves obovate, 8—12.5 by 4.5—6 cm, midrib crested above, angular below. *Malaya* **102. P. calophylloides**
- 20.a. Corolla with a ring of ferruginous hairs between the stamens, otherwise glabrous, reflexed in anthesis. Leaves obovate, obovate-spathulate or spathulate, (3—)7—15 by 1.7—4 cm, rounded or obtuse, rarely obtusely acuminate at apex. Pedicels ferruginously sericeous. Sepals ferruginously appressedly tomentose on outside. *Borneo and Philippines*. **104. P. pseudorostratum**
- b. Corolla ferruginously tomentose on outside in middle-line and apex of lobes, and on the whole tube, glabrous on inside, not reflexed in anthesis. Leaves spathulate, 2.5—8.5 by 1.5—4 cm, short obtusely acuminate, rarely rounded at apex. Pedicels ferruginously pubescent. Sepals ferruginously tomentose on outside. *Malaya to Banka and Borneo*. **97. P. microphyllum**
- 21.a. Filaments of stamens woolly pubescent. Corolla on outside ferruginously pubescent on tube and base of lobes, on inside ferruginously woolly pubescent between the stamens, reflexed in anthesis. Leaves spathulate or obovate, 4—11 by 1.5—4.5 cm, retuse, rounded or short obtusely acuminate. Pedicels ferruginously tomentose. Sepals ferruginously sericeous on outside. *Borneo* **105. P. pseudocuneatum**
- b. Filaments of stamens glabrous. 22
- 22.a. Petioles, pedicels and underside of midrib of leaves densely woolly pubescent. *Borneo*. **98. P. rufolanigerum**
- b. Leaves glabrous on either side, petioles glabrous, pedicels tomentose or sericeous-tomentose. 23
- 23.a. Leaves spathulate or obovate, 4—8 by 3—4.5 cm, rounded, obtuse or obtusely acuminate, midrib flat above. Sepals elliptic-oblong or lanceolate, 5—7 by 3.5—4.5 mm. *Ceylon*. **93. P. himmolepidea**
- b. Leaves obovate-spathulate to obovate-orbicular, (3—)5—8(—12) by (1.5—)2—3.5(—5) cm, cordate, rounded or short obtusely and broadly acuminate at apex, midrib grooved above and distinctly crested at least in the basal part. Sepals ovate, 2.5—3 by c. 3 mm. *Philippines*. **103. P. cuneifolium**
- 24.a. Tertiary nervation of leaves parallel to the secondary nerves, hardly distinguishable from each other. Leaves spathulate or obovate, 4—11 by 1.5—4.5 cm, retuse,

- rounded or short obtusely acuminate at apex. Corolla 3—4 mm long. *Borneo*
105. *P. pseudocuneatum*
- b. Tertiary nervation reticulate, easily distinguishable from the secondary nerves. Corolla longer than 5.5 mm 25
- 25.a. Secondary nerves 16—23 pairs. Leaves oblanceolate, obovate or obovate-oblong, 12.5—20(—35) by 4—8(—12) cm. *East Pakistan, India, Burma* 88. *P. polyanthum*
- b. Secondary nerves 7—13 pairs. Leaves obovate-oblong, spatulate, obovate-elliptic or elliptic 26
- 26.a. Stipules linear, up to 8 by 1 mm. Leaves and petioles entirely glabrous. Base of style in fruit enlarged. Leaves elliptic, elliptic-obovate or obovate, 7—14 by 3.5—7 cm. *Burma, Malaya* 94. *P. sukoei*
- b. Stipules lanceolate, up to 5 by 2 mm. Leaves and petioles with a pubescence. Base of style in fruit not widened 27
- 27.a. Pedicels much longer than petioles, 1.5—3.5 cm long. Flowers in 6—10-flowered clusters. Stipules lanceolate, up to 5 by 2 mm. Apex of leaf rounded, obtuse or indistinct obtusely acuminate. Sepals lanceolate or ovate-lanceolate, 8—11 by 3—4 mm, ferruginously tomentose except on inside on middle-line. Corolla 8—10 mm long. Filaments of stamens in bud S-like curved, glabrous. *Ceylon*
87. *P. rubiginosum*
- b. Pedicels about as long as petioles, c. 1 cm long. Flowers solitary or in 2-flowered clusters. Stipules lanceolate, c. 1 by 0.5 mm. Apex of leaf obtusely acuminate to subcuspidate. Sepals ovate, 5—7 by 3—4 mm, ferruginously woolly-tomentose on inside near apex only. Corolla 5.5—6 mm long. Filaments of stamens in bud straight, densely yellowish pilose on inside. *Travancore* 92. *P. bourdillonii*
- 28.a. Midrib of leaf crested above. Secondary nerves forked at tips or curved back and archingly joined 29
- b. Midrib of leaf never crested above. Secondary nerves archingly joined by curving forward 30
- 29.a. Fruits oblong or ovoid-oblong, sometimes oblique, 3.6—5 by 1—1.8 cm, 1-seeded, pointed at either end. Leaves elliptic to subelliptic, obovate or obovate-oblong, (5—)7—16 by 2.8—5.5 cm, apex acute, rounded or obtusely acuminate, midrib angular below, secondary nerves 8—16(—25) pairs, tertiary nerves transverse but almost parallel to the secondary nerves, in basal part of leaf reticulate. *Java to Morotai, Timor, New Guinea, New Britain and Solomons* 106. *P. amboinense*
- b. Fruits globose-ellipsoid, c. 1.2 by 1.2 cm, 2- or 3-seeded. Leaves elliptic-obovate, (6—)8—12 by 3—4.5 cm, apex short and indistinct obtusely acuminate, sometimes emarginate, midrib rounded below, secondary nerves 7—14 pairs, tertiary nerves widely reticulate. *Philippines* 101. *P. dubardii*
- 30.a. Leaves (8—)12—17(—50) by (2.5—)4.5—6.5(—12) cm, secondary nerves (9—)16—20(—33) pairs, archingly joined very close to the margin of the leaves. Outer sepals ovate, 3—4 by 2—3.5 mm. Style hardly exceeding the corolla. Fruits globose, ellipsoid or ovoid, 2—3.5 by 1—3 cm. *Malaya, Sumatra, Borneo and surrounding islands, often cultivated elsewhere* 81. *P. gutta*
- b. Leaves 4.7—8.3 by 2.2—3.7 cm, secondary nerves 9—12 pairs, archingly joined rather far from the margin of the leaf. Outer sepals triangular, c. 2 by 2 mm. Style long exsert. Fruits unknown. *New Guinea* 108. *P. brassii*
- 31.(8).a. Stipules broadly ovate-oblong, 3—6 mm wide at base, obtuse, rarely acute (cf. *P. majas*) 32
- b. *) Stipules lanceolate to subacicular, or triangular, up to 3 mm broad at base, almost usually acute or acutely acuminate 36
- 32.a. Stipules lanceolate, oblong or oblong-ovate, 9—15 by 4—6 mm, pubescent on outside over the whole surface. Secondary nerves of leaves 18—28 pairs 33
- b. Stipules broadly ovate, 4—6 by 3.5—6 mm, often pubescent on outside in the middle only. Secondary nerves (10—)12—18 pairs 34
- c. Stipules broadly ovate-oblong, 6—11 by 3—6 mm, obtuse, crested on outside, glabrous on either side. Secondary nerves (13—)16—19 pairs. Leaves obovately

*) Stipules are unknown in 29. *P. komakomar* but this species is included under item b. If included under a it is to be separated from the 6 species also included there by the 2-sided pubescence of the sepals.

- oblong to spatulate, 22—40 by 8.5—16 cm, rounded and usually short obtusely acuminate. Petioles 1.5—3 cm long, flat above. Fruits ellipsoid, 1.5—2.5 by c. 1.2 cm. *Philippines* 22. **P. cuprifolium**
- 33.a. Leaves ovate, ovate-oblong, or subovate, 12—27 by 5—13 cm, obtuse and short obtusely acuminate, acumen up to 5 mm long, underside ferruginously or yellowish hirsute, denser so on nerves and midrib. Petioles 2—4.5 cm long, narrowly grooved above. Pedicels 2—4 cm long. Sepals ovate, triangular or subelliptic, 4.5—10 by 5—8 mm. Stamens 12, entirely glabrous. *Sumatra, Malaya, Borneo* 7. **P. hispidum**
- b. Leaves oblong, 24—48 by 8—14.5 cm, obtuse and long obtusely acuminate, acumen up to 25 mm long, underside sparsely brownish puberulous along midrib only. Petioles 0.9—2.6 cm long, flat above. Pedicels 0.3—0.8(—1) cm long. Sepals ovate-triangular, 2.5—4 by 3—5 mm. Stamens 18—21, filaments ferruginously hirsute, anthers ferruginously sericeous. *Borneo* 18. **P. rivulare**
- 34.a. Stamens 12. Secondary nerves 9—18 pairs, diminishing until inconspicuous near margin. Leaves obovate or subpanduriform, 18—25(—41) by 8.5—11.5 (—18) cm. Corolla-lobes ovate-lanceolate, 3—5 by 1.5—2 mm, obtuse. Ovary pale ferruginously hirsute in the apical half only. Pedicels up to 4 mm long in flower. Petioles (1—)2—4 cm long. *Borneo* 19. **P. kinabaluense**
- b. Stamens 18. Secondary nerves 12—18 pairs. Pedicels (3—)7—25 mm long in flower. Petioles 0.9—1.5 cm long 35
- 35.a. Leaves obovate or pandurate, 16—25 (—31) by 7—12(—16) cm, secondary nerves 15—18 pairs, diminishing until inconspicuous near margins. Lobes of corolla lanceolate-ovate, 9—12 by 1.5—3 mm, obtuse or truncate at apex. Ovary glabrous. *Philippines* 13. **P. sorsogonense**
- b. Leaves broadly obovate, 16—25 by 10—15 cm, secondary nerves 12—17 pairs, archingly joined very close to the margin. Corolla-lobes elliptic-oblong, 6—7 by 2—2.5 mm, acute or subacute at apex. Ovary ferruginously hirsute. *Borneo* 14. **P. majas**
- 36.a. Calyx pubescent on inside, often also on the outside 37
- b. Calyx glabrous on inside, pubescent or glabrous on outside 46
- 37.a. Mature leaves glabrous on either side 38
- b. Mature leaves at least on underside pubescent, sometimes on midrib only 41
- 38.a. Secondary nerves 5—7 pairs. Leaves elliptic, obovate or obovate-rotundate, 3—5(—9.5) by 1.5—3(—4.5) cm. Petioles 0.7—0.9 cm long. Pedicels 0.5—0.8 cm long. Corolla in bud c. 2 mm long. *Borneo* 36. **P. multiflorum**
- b. Secondary nerves 5—10 pairs, very often grooved above or inconspicuous. Leaves obovate or elliptic-obovate, rarely elliptic, 5—10.5(—16) by 2.3—5(—7.5), in sterile specimens 8—19.5 by 4.5—7.5 cm. Petioles 1—2.8 cm long. Pedicels 3—7(—14) mm long. Corolla 3—4 mm long. *Indo-China, Malaya, Sumatra to Philippines and New Guinea*. 48. **P. ridleyi**
- c. Secondary nerves (9—)10—20 pairs, never grooved above, but if so then pedicels 1.5—3 cm long, tertiary nervation grooved above. Petioles 1.3—2.8 cm long. Pedicels 0.7—3 cm long. Corolla 9—14.5 mm long 39
- 39.a. Anthers caudate and fimbriate at apex, ferruginously tomentose-woolly on inside. Leaves obovate, obovate-oblong, or subelliptic, 8—17.5 by 3.5—7.5 cm, obtusely acuminate at apex. Flowers 1 or 2 in each axil. Fruits oblong or ellipsoid, c. 4 by 1.5 cm. *India* 49. **P. ellipticum**
- b. Anthers acutely acuminate or bifid, glabrous. Flowers in 3—7-flowered axillary clusters. Fruits globose, subglobose or ovoid, 1.4—2.5 by 1.2—2.5 cm 40
- 40.a. Fruits ovoid, 1.4—1.7 by 1.2—1.3 cm, glabrous. Branchlets dark brown tomentose. Leaves rounded, rarely short obtusely acuminate at apex, secondary nerves 11—13 pairs. Pedicels 1.5—2.2 cm long. Stamens 9—12 mm long, anthers 3.5—4 mm long, bifid at apex. Style up to 22 mm long. *Ceylon* 2. **P. grande**
- b. Fruits oblong, 2—2.5 by 1—1.5 cm, densely ferruginously tomentose. Branchlets greyish tomentose. Leaves oblong-obovate, obovate or elliptic, 14—19 by 4—7.5 cm, abruptly short obtusely acuminate at apex, sometimes obtuse or rounded, secondary nerves 9—11 pairs. Pedicels 0.7—1.1 cm long. Stamens 3.5—4 mm long, anthers 2—2.5 mm long, acutely acuminate at apex. Style 8—11 mm long. *Malaya and Siam* 50. **P. oxleyanum**
var. **glabratum**

- 41.a. *) Anthers and filaments of stamens glabrous 42
 b. Either anthers or filaments pubescent 43
- 42.a. Stipules lanceolate-linear, up to 11 mm long. Secondary nerves 12—16(—19) pairs, diminishing until inconspicuous near margin, uppermost nerves sometimes archingly joined. Sepals lanceolate, 5—6 by 2—2.5 mm. Corolla 12—16 mm long, ferruginously tomentose on outside on the tube and in the centre of the lobes. Fruits glabrous. *Sumatra, Borneo, Celebes, Batjan, Amboina*.
 85. *P. quercifolium*
- b. Stipules lanceolate, up to 2 by 1 mm. Secondary nerves 14—20 pairs, archingly joined. Sepals triangular-ovate, c. 4 by 3.5 mm. Corolla c. 9 mm long, entirely glabrous. Fruits densely ferruginously tomentose. *Malaya* 50. *P. oxleyanum*
 var. *oxleyanum*
- 43.a. **) Secondary nerves 16—23 pairs, archingly joined near margin of leaf. Throat of corolla ferruginously pilose between the stamens, filaments of the latter with long brown hairs mainly in the basal part. *East Pakistan, India, Burma*
 88. *P. polyanthum*
- b. Secondary nerves 6—12 pairs, diminishing until inconspicuous near margin of leaf. Throat of corolla glabrous 44
- 44.a. Branchlets, leaves on underside of midrib, petioles and pedicels woolly tomentose. Tube of corolla ferruginously sericeous on outside. *Riouw, Borneo*
 42. *P. dasyphyllum*
- b. This pubescence tomentose or hirsute, never woolly. Corolla glabrous or with a few hairs in the middle-line of the lobes 45
- 45.a. Leaves oblanceolate, elliptic or oblong, 7—20 by 2.5—5.5 cm, glabrous except dark brown or ferruginously hirsute in the basal half of either side of midrib, the latter grooved above. Sepals ovate, 6—7.5 by 3.5—4.5 mm. Corolla 9—10 mm long, entirely glabrous. *Malaya, Riouw, Sumatra* 66. *P. stellatum*
- b. Leaves obovate, rarely elliptic, (7—)11—19 by (3.5—)4.5—9 cm, glabrous above, densely tomentose or sericeous below, midrib with 1 or 2 longitudinal crests densely tomentose or sericeous below, midrib grooved above. Sepals deltoid-ovate, 3—3.5 by 2.5—3 mm. Corolla c. 6 mm long, on outside with a few ferruginous hairs in the middle-line of the lobes. *Malaya, Borneo, Mindoro, Ternate, Batjan, New Guinea and perhaps also on Celebes* 83. *P. calophyllum*
- 46.(36).a. Stamens 20—25, filaments with long ferruginous hairs, anthers glabrous. Leaves obovate, 8—23 by 4—8.2 cm, rounded or short obtusely acuminate at apex, secondary nerves (10—)13—19 pairs, diminishing until inconspicuous near margin. Corolla densely ferruginously appressedly tomentose on outside in the centre of lobes and base of tube. *Malaya, Sumatra, Riouw* 54. *P. burekii*
- b. Stamens (8—)12—18(—20), filaments glabrous or pubescent. Corolla glabrous or partly sparsely hairy on outside 47
- 47.a. Stamens 18—20 48
 b. Stamens 8—12(—15). See also 26. *P. ericalyx* and 63. *P. foxworthyi* both with 15—18 stamens 56
- 48.a. Branchlets glabrous. Leaves obovate-oblong, (8—)12—18 by 3.2—7.2 cm, indistinctly obtusely acuminate, obtuse or rounded at apex, entirely glabrous. Petioles 0.9—2 cm long, glabrous. Pedicels 2.5—3.3 cm long, glabrous. Corolla 3—4 mm long, glabrous. Ovary glabrous. Fruits ovoid, c. 3.5 by 2 cm, glabrous. *Philippines* 64. *P. glabrum*
- b. Branchlets with a pubescence, at least at apex 49

*) Here also 58. *P. mindanaense* Merrill and 29. *P. komakomar* van Royen of which no flowers are known but which differ from each other as follows:

Secondary nerves 13—15 pairs. Petioles 2.8—3.7 cm long. *Philippines*

58. *P. mindanaense*

Secondary nerves 17—22 pairs. Petioles 1—2.5 cm long. *New Guinea*

29. *P. komakomar*

**) Cf also 17. *P. erythrospermum* H. J. Lam which has 12—15 pairs of nerves, diminishing until inconspicuous near margin. Flowers unknown. Fruits oblong, 2.5—3.8 by 1—1.8 cm. *Solomons*.

- 49.a. Mature leaves glabrous on either side 50
 b. Mature leaves at least with a pubescence on underside 53
 50.a. Pedicels (2.5—3.8 cm) much longer than petioles (0.9—1.5 cm). Corolla glabrous. *Philippines* 72. *P. lanceolatum*
 b. Pedicels (0.8—3.2 cm) as long as or slightly longer than petioles or shorter (0.5—2.6 cm). Corolla either glabrous or with scattered hairs on outside and/or inside 51
 51.a. Stamens entirely glabrous 52
 b. Filaments glabrous, anthers sparsely ferruginously hairy. Leaves spatulate, obovate, obovate-oblong or elliptic, (10—)14—26(—30) by (4—)7—9.3(—12) cm. Petioles 0.7—1.8(—2.5) cm. Pedicels 0.9—1.5(—3.2) cm. Corolla with few ferruginous hairs on outside in middle-line of lobes and in throat. *Sumatra to New Guinea* 53. *P. obtusifolium*
 52.a. Leaves elliptic, oblong or oblong-lanceolate, 10—20 by 3.5—8 cm. Petioles 1.4—2.6 cm long. Corolla glabrous. *Siam* 73. *P. garrettii*
 b. Leaves obovate or oblong-obovate, 8—12 by 3—5 cm. Petioles 0.5—1.2 cm long. Corolla with scattered ferruginous hairs on outside of tube and in the middle-line of the lobes. *Luzon* 63. *P. foxworthyi*
 53.a. Petioles (1.4—3 cm) longer than pedicels (0.5—0.9 cm). Leaves ovate or obovate, 11.2—20 by 5—12 cm, yellowish ferruginously tomentose-hirsute below. Stamens 15—18, filaments brownish woolly-hirsute, anthers glabrous. Ovary ferruginously woolly puberulous. *Borneo* 26. *P. eriocalyx*
 b. Petioles (0.7—3.5 cm) shorter than pedicels (1.3—5 cm) 54
 54.a. Leaves ferruginously or dark reddish brown woolly below, 8—20 by 6—11 cm. Petioles and pedicels densely woolly-tomentose. Stipules lanceolate-acicular, up to 3 by 1 mm. *Philippines* 27. *P. barnesii*
 b. Leaves sericeous pubescent as are petioles and pedicels. Stipules boat-shaped, lanceolate, up to 7 by 3 mm, or lanceolate and 6—8 by 1.5—3 mm large 55
 55.a. Petioles 0.7—2.2 cm long. Stamens entirely glabrous. Ovary glabrous. Leaves obovate, obovate-oblong, spatulate or subelliptic, 17—37 by 6—10 cm, obtuse and acutely or obtusely acuminate, midrib angular below. *Philippines* 12. *P. philippense*
 b. Petioles 2—3.5 cm long. Filaments of stamens glabrous, anthers ferruginously tomentose. Leaves narrowly spatulate or oblanceolate, 18—25 by 4—8 cm, rounded and short obtusely acuminate at apex, midrib rounded below. Ovary ferruginously tomentose. *Philippines* 79. *P. elongatum*
 56.a. Mature leaves glabrous below *) 57
 b. Mature leaves pubescent below, sometimes on midrib and nerves only, but then with numerous hairs 91
 57.a. Anthers with a pubescence on one or either side 58
 b. Anthers glabrous 80
 58.a. Ovary glabrous 59
 b. Ovary pubescent 63
 59.a. Secondary nerves 10—12 pairs, irregularly archingly joined, tertiary nerves few, widely apart. Petioles with 2—4 longitudinal crests. Fruits narrowly ellipsoid, often oblique, 4—5 by 1.5—2 cm. Leaves obovate-oblong, obovate or spatulate, 10—17 by 4.5—7.5 cm, rounded or cordate at apex. *Formosa and some small surrounding islands, Luzon* 16. *P. formosanum*
 b. Secondary nerves of leaves diminishing until inconspicuous near margin. Petioles flat or grooved above. Fruits obovoid, globose, ovoid or obpyriform, 1.2—3 by 0.7—2.2 cm 60
 60.a. Leaves in general obovate or oblong-obovate, sometimes oblong, (6—)11—25 (—45) by 2.5—7(—17) cm, rounded, obtuse or obtusely acuminate at apex. Secondary nerves 5—13 pairs. Length of petioles (0.7—3.2 cm) about the same length or slightly longer than pedicels (0.4—2.5 cm). Corolla 8—15 mm long. Style 2—2.5 cm long. *India to Moluccas and Philippines* 61

*) In 65. *P. neo-ebudicum*, 47. *P. pierrei* and 62. *P. tenuipetiolatum* sometimes a few scattered hairs on lower side of midrib, in 44. *P. laevifolium* a few hairs along upper side of midrib.

- b. Leaves in general elliptic, sometimes ovate, oblong-ovate or elliptic-obovate, 5—12(—23) by 2.3—7.5(—9.7) cm, emarginate, rounded, obtuse or obtusely acuminate at apex. Secondary nerves 8—19 pairs. Petioles 2—4 times the length of pedicels. Corolla 3—7.5 mm long. Style 1.5—2.2 cm long. 62
- 61.a. Corolla in bud glabrous on either side, 8—10 mm long. Tertiary nerves dense, near the midrib arising almost perpendicular to the latter. Pedicels 2—2.5 cm long. Petioles 1.5—3 cm long. *Philippines* 34. **P. elliptilimum**
- b. Corolla in bud ferruginously sericeous in alternipetalous lines on the tube, 1—1.5 cm long. Tertiary nerves rather apart, curving backwards from midrib. Pedicels 0.4—2 cm long. Petioles 0.7—5.2 cm long. *India to the Moluccas, Philippines and Lesser Sunda Islands* 1. **P. obovatum**
- 62.a. Secondary nerves 5—10 pairs, often grooved above. Tertiary nerves often grooved above. Flowers often in a terminal pseudo-inflorescence, or axillary. Corolla 3—4 mm long, entirely glabrous. Filaments of stamens glabrous. Fruits obovoid, 1.2—1.4 by c. 0.7 cm. *Indo-China, Malaya, Sumatra to Banka, Philippines and New Guinea* 48. **P. ridleyi**
- b. Secondary nerves 7—14 pairs, prominulous above and often grooved as well, tertiary nerves prominulous above. Flowers always axillary. Corolla 6—7.5 mm long, tube on outside ferruginously sericeous. Filaments of stamens densely woolly, sometimes at base only. Fruits globose or ovoid, 2—2.7(—3) by 1.5—2(—2.4) cm. *Malaya, Sumatra and islands to the west of the latter, and also on Borneo* 45. **P. hexandrum**
- 63.a. Corolla glabrous on either side 64
- b. Corolla on one or either side with a pubescence, sometimes only part of the corolla covered 74
- 64.a. Petioles and pedicels glabrous. Filaments of stamens with long white hairs in the apical part. *Borneo* 74. **P. cochleariifolium**
- b. Petioles and pedicels pubescent or glabrous. Filaments pubescent but never with white hairs, or glabrous 65
- 65.a. Petioles glabrous 66
- b. Petioles pubescent 69
- 66.a. Petioles 2—6 times the length of pedicels. Leaves in general narrower than 10 cm 67
- b. Petioles 1—1½ the length of the pedicels. Leaves oblong-elliptic, 19—32 by 10—14.5 cm, obtusely acuminate at apex, glabrous on either side. Filaments of stamens glabrous. *Samoa, Fiji* 3. **P. stehlinii** *)
- 67.a. Secondary nerves archingly joined, 8—12(—16) pairs. *New Guinea, New Britain, Solomons, Northern Australia* 107. **P. galactoxylum**
- b. Secondary nerves diminishing until inconspicuous near margin 68
- 68.a. Secondary nerves 5—10 pairs, often grooved above. Flowers in 5—11-flowered, axillary clusters or along a terminal shoot. Corolla 3—4 mm long. Filaments of stamens S-shaped at apex. Fruits obovoid, 1.2—1.4 by c. 0.7 cm, scar of seed narrow, c. 2 mm broad. *Indo-China, Malaya, Sumatra to Philippines and New Guinea* 48. **P. ridleyi**
- b. Secondary nerves 10—15 pairs. Flowers solitary or in 2—4-flowered, axillary clusters, never along a terminal shoot. Corolla 6—7 mm long. Filaments of stamens straight. Fruits ovoid or fusiform, sometimes oblique, 2.5—2.9 by 1.1—1.7 cm, scar covering half the surface of the seed. *Philippines* 62. **P. tenuipetiolatum**
- 69.a. Leaves oblong-elliptic, 19—32 by 10—14.5 cm, secondary nerves 10—12 pairs. Pedicels 3.5—4.5 cm long. *Samoa, Fiji* 3. **P. stehlinii**
- b. Leaves narrower than 10 cm, if wider then the number of secondary nerves (9—)16—20(—33) pairs and pedicels 1.5—12 mm long 70
- 70.a. Petioles 2—3.5 cm long and pedicels 1.5—3.5 cm, both ferruginously woolly. Leaves obovate-elliptic, 11—15 by 5.5—7.5 cm, secondary nerves 9—11 pairs. *New Hebrides* 65. **P. neo-ebudicum**
- b. Petioles (0.7—)3—4.5(—6.5) cm long and pedicels 0.3—1.2 cm long, sericeous or tomentose pubescent 71

*) Closely related to *P. stehlinii* is 4. *P. oxyspermum* H. J. Lam with 5—7 pairs of secondary nerves and found on Samoa.

- 71.a. Petioles (0.6—1.8 cm) as long as or $2\frac{1}{2}$ —3 times the length of pedicels (0.3—0.8 cm). Apex of anthers bifid or obtuse or acute 72
- b. Petioles (0.7—)3—4.5(—6.5) cm $4\frac{1}{2}$ — $5\frac{1}{2}$ times the length of pedicels (0.1—1.2 cm). Leaves very variable, (8—)12—17(—50) by (2.5—)4.5—6.5 (—12) cm, secondary nerves (9—)16—20(—33). Stamens 4.5—7 mm long, anthers aristulate at apex. Fruits globose, ellipsoid or ovoid, 2—3.5 by 1—3 cm, rounded, obtuse, or acuminate at apex. *Malaya, Sumatra, Borneo, and surrounding islands, cultivated elsewhere* 81. *P. gutta*
- 72.a. Petioles (1—2.2 cm) as long as pedicels (1.2—2 cm). *Siam* 78. *P. koratense*
- b. Petioles (0.6—1.8 cm) much longer than pedicels (0.3—0.8 cm) 73
- 73.a. Fruits oblong or ovoid-oblong, sometimes oblique, 3.6—5 by 1—1.8 cm, pointed at either end. Leaves (5—)7—16 by 2.8—5.5 cm, base broadly cuneate, secondary nerves 8—17(—25) pairs, petioles 0.6—1.4 cm long. Anthers obtuse or acute. *Java to Celebes, Morotai and New Guinea* 106. *P. amboinense*
- b. Fruits ovoid or fusiform, 2.5—2.9 by 1.1—1.7 cm, obtusely acuminate at apex, rounded at base. Leaves 5—12 by 3—5.5 cm, base narrowly cuneate, secondary nerves 10—15 pairs, petioles 0.9—2.2 cm. Anthers bifid at apex. *Philippines* 62. *P. tenuipetiolatum*
- 74.a. Petioles glabrous or whitish or greyish puberulous but ultimately glabrous 75
- b. Petioles brownish or ferruginously tomentose, or brownish or ferruginously woolly-tomentose, if greyish puberulous the pedicels 5—7 mm long and these cinnamomously puberulous 77
- 75.a. Corolla 9—11.5 mm long, ferruginously pilose in throat, lobes patent in anthesis. Sepals ovate, 5.5—7 by 4—5.5 mm. Pedicels 2.5—3 cm long, tomentose. Ovary supported by a disk. *Ceylon* 41. *P. petiolare*
- b. Corolla 6—8 mm long, ferruginously sericeous on inside at tips of lobes or with a few hairs in throat, lobes reflexed in anthesis. Sepals broadly ovate to subrotundate, triangular-ovate or triangular, 1.5—3 by 1.5—3 mm. Pedicels 0.4—1.5(—2.8) cm, sericeous. Ovary without a disk 76
- 76.a. Stipules up to 8 by 2 mm. Secondary nerves 10—17 pairs. Sepals sericeous pubescent on outside. Filaments of stamens glabrous. Fruits ovoid or obovoid, sometimes oblique, 3—4 by 2—2.5 cm. *Sumatra to Bali, Celebes, Moluccas, and New Guinea* 53. *P. obtusifolium*
- b. Stipules up to 2 by 1 mm. Secondary nerves 7—13 pairs. Sepals puberulous on outside. Filaments of stamens densely woolly, sometimes at base only. Fruits globose or ovoid, 2—2.7(—3) by 1.5—2(—2.4) cm. *Malaya, Sumatra, islands west of the latter, also on Borneo*
- 77.a. Pedicels more than 2 cm long, ferruginously tomentose. Petioles 1.5—6.5 cm, brownish tomentose. Secondary nerves (7—)9—14(—22) pairs. *Philippines, Celebes, Talaut Islands* 60. *P. luzoniense*
- b. Pedicels at the utmost 1.6 cm long 78
- 78.a. Stipules pubescent on either side. Petioles 0.6—2 cm long, brownish or ferruginously woolly-tomentose. Fruits ovoid or obovoid to ellipsoid, 1.2—2.8 by c. 1 cm, rounded at apex. Pedicels 0.8—1.6 cm, brownish or ferruginously woolly-hirsute or tomentose. Secondary nerves 7—12 pairs. *Riouw, Borneo* 42. *P. dasyphyllum*
- b. Stipules pubescent on outside only 79
- 79.a. Petioles (1—)1.5—2.2 cm, flat above and minutely grooved, sometimes in the apical part only. Pedicels cinnamomously puberulous. Corolla 7—9 mm long. Stamens 4.5—5 mm long. *New Guinea* 57. *P. morobense*
- b. Petioles 0.3—0.9 cm, grooved or flat above and sometimes crested as well. Pedicels ferruginously tomentose. Corolla 2—4 mm long. Stamens c. 1.5 mm long. *Fiji* 15. *P. fidjiense*
- c. Petioles 0.5—0.8 cm, flat above. Pedicels cinnamomously puberulous. Corolla c. 1.5 mm long. Stamens c. 1 mm long. *New Guinea* 51. *P. simun*
- 80.a. Juvenile branchlets woolly pubescent. *Sumatra* 77. *P. confertum*
- b. Juvenile branchlets tomentose, puberulous, sericeous or glabrous 81
- 81.a. Juvenile branchlets glabrous 82
- b. Juvenile branchlets not glabrous 83
- 82.a. Leaves (15—)20—28 by (5—)8—14 cm, obtusely acuminate. Flowers solitary or in 2- or 3-flowered clusters. Ovary ferruginously puberulous. *Carolines* 76. *P. karrak*

- b. Leaves 8.5—18 by 2.5—6 cm, obtuse. Flowers in 6- or 7-flowered clusters. Ovary glabrous. *Fiji* 75. **P. hornei**
- 83.a. Secondary nerves 20—26 pairs, ascending at an angle of 60°—90°. Petioles 1.6—3.5 cm. Fruits ovoid, ellipsoid or obovoid. *Siam, Sumatra, Riouw, Borneo, Billiton, Java* 109. **P. sumatranum**
- b. Secondary nerves 7—16 pairs, but if up to 33, then ascending at an angle of 45°—50°, or petioles 0.7—1.1 cm 84
- 84.a. Petioles (0.8—2.5 cm) and pedicels (0.9—2.4 cm) almost equal in length. Secondary nerves 7—13 pairs. Fruits obovoid, 1—1.7 by 1—1.5 cm, glabrous. *Philippines* 61. **P. bataanense** *)
- b. Petioles much longer than pedicels, but if almost equal then secondary nerves 12—16(—20) pairs 85
- 85.a. Leaves narrowly elliptic or elliptic-obovate, 7—15 by 2—4.5 cm, secondary nerves 9—13 pairs. Pedicels 4—7 mm long, densely ferruginously tomentose. *Ceylon* 44. **P. laevifolium**
- b. Leaves obovate to spatulate, but if elliptic the secondary nerves 7—10 pairs and pedicels 7—17 mm long, ferruginously puberulous 86
- 86.a. Petioles 5—6(—15) times the length of pedicels. *Malaya, Sumatra, Borneo and surrounding islands, cultivated elsewhere* 81. **P. gutta**
- b. Length of petioles 1—3.5 times the length of pedicels 87
- 87.a. Midrib of leaf crested above 88
- b. Midrib of leaf flat or grooved above, (rarely crested in part of the leaf, see 37. *P. walsurifolium*) 89
- 88.a. Leaves often coppery red when dry. Secondary nerves irregularly archingly joined near margin. Filaments of stamens glabrous. Fruits obliquely fusiform, 3—5 by 1—1.7 cm. *Malaya, Sumatra, Riouw, Lingga, Banka, Java, Borneo* 96. **P. xanthochyrum**
- b. Leaves brownish or greenish when dry. Secondary nerves diminishing until inconspicuous near margin. Filaments of stamens entirely densely woolly or at base only. *Malaya, Sumatra, islands west of it, and also on Borneo* 45. **P. hexandrum**
- 89.a. Secondary nerves 13—16 pairs. Leaves 14—22 by 6—8 cm. Petioles (2—) 2.5—4 cm. Pedicels stout. Sepals ovate, 5—6.5 by 3.5—4.5 mm. Stamens (5.5—) 7.5—8.5 mm. *Borneo* 86. **P. rigidum**
- b. Secondary nerves 7—10 pairs. Leaves 4—16 by 2—6 cm. Petioles 0.8—2.5 cm. Pedicels slender. Sepals suborbicular or ovate, 2—3.5 by 1.5—2.5 mm. Stamens 3.5—5.5 mm long 90
- 90.a. Leaves narrowly elliptic, obovate-elliptic or oblanceolate, 7—16 by 3—6 cm, obtusely acuminate. Pedicels 7—17 mm long, sparsely greyish or ferruginously puberulous. Corolla 8—10 mm long. Fruits ovoid, c. 3 by 1.8—2 cm. *Borneo* 47. **P. pierrei**
- b. Leaves obovate or rotundate-obovate, 4—9.5 by 2—4.5 cm, emarginate or rounded, rarely short obtusely acuminate. Pedicels 3.5—7 mm long, ferruginously tomentose. Corolla 6—7 mm long. Fruits globose or ellipsoid, 1—2 cm in diam. *Malaya, Sumatra, Borneo* 37. **P. walsurifolium**
- 91.(56).a. Mature petioles glabrous 92
- b. Mature petioles pubescent, sometimes only partly so 97
- 92.a. Corolla at least pubescent or woolly between the stamens 93
- b. Corolla glabrous between the stamens 94
- 93.a. Secondary nerves 6 or 7. Leaves obovate to elliptic-obovate. Petioles 1—1.6 cm long. Flowers in 2- or 3-flowered clusters. Pedicels 3—7.5 mm long. *Borneo* 35. **P. crassifolium**
- b. Secondary nerves (10—) 17—20(—22) pairs. Leaves broadly ovate, suboblong, elliptic or obovate. Petioles 1.5—5.5 cm long. Flowers in 3—6-flowered clusters. Pedicels 0.8—1.5(—3) cm long. *Borneo, Celebes* 52. **P. leiocarpum**
- 94.a. Anthers glabrous 95
- b. Anthers pubescent 96

*) Here also 67. *P. merrillii* Dubard with ellipsoid fruits and smaller corolla (up to 7.5 mm against 10—14 mm).

- 95.a. Secondary nerves 7—13 pairs. Petioles flat above and crested as well. Pedicels 0.9—2.4 cm long. Fruits obovoid, 1—1.7 by 1—1.5 cm. *Philippines* 61. *P. bataanense*
- b. Secondary nerves 12—16(—20) pairs. Petioles grooved above. Pedicels (0.15—) 0.3—0.9 cm. Fruits obliquely fusiform, 3—5 by 1—1.7 cm. *Malaya to Sumatra, Banka, Java and Borneo* 96. *P. xanthochyllum*
- 96.a. Styles 2—2.5 cm long. Ovary conoid, glabrous. Pedicels (4—)9—15 mm long. Stamens 8—12. *India to Moluccas and Philippines* 1. *P. obovatum*
- b. Styles 0.3—0.35 cm long. Ovary disciform-obovoid, ferruginously puberulous. Pedicels 5—7 mm long. Stamens 12. *New Guinea* 57. *P. morobense*
- 97.a. Anthers glabrous 98
- b. Anthers pubescent, sometimes a few hairs only*) 115
- 98.a. Pedicels longer or as long as petioles**) 99
- b. Pedicels shorter than petioles 107
- 99.a. Secondary nerves (1—)10—12(—16) pairs 100
- b. Secondary nerves 16—27 pairs 103
- 100.a. Leaves obovate, obovate-oblong, spatulate or subelliptic, 17—37 by 6—10 cm. Petioles with 2 longitudinal crests above. *Philippines* 12. *P. philippense*
- b. Leaves 6—20 by 2.2—6 cm, of different shapes. Petioles with one rib, or flat or grooved above 101
- 101.a. Fruits ellipsoid to obovoid, c. 3.5 by 2 cm. Pedicels 1.2—3.5 cm long 102
- b. Fruits obliquely fusiform, 3—5 by 1—1.7 cm long. Pedicels 0.15—1.2 cm long. *Malaya to Sumatra, Banka, Java and Borneo* 96. *P. xanthochyllum*
- 102.a. Petioles 1.5—1.8 cm long, broadly ribbed above. Ovary sparsely ferruginously sericeous at apex only. *Luzon* 59. *P. loheri*
- b. Petioles 0.5—1 cm long, flat above. Ovary glabrous. *Luzon, Mindanao* 9. *P. montanum*
- 103.a. Leaves woolly tomentose below, obovate or obovate-oblong, 12—32 by 6.5—14.5 cm, obtuse or retuse at apex. Secondary nerves 17—23 pairs. *Malaya* 6. *P. clarkeanum*
- b. Leaves sericeous, appressedly tomentose, hirsute or puberulous below 104
- 104.a. Leaves narrowly lanceolate, long acutely acuminate at apex, 13—17 by 4—6 cm. *Borneo* 11. *P. elegans*
- b. Leaves neither lanceolate nor acutely acuminate at apex 105
- 106.a. Pedicels 1.5—12 mm long. Corolla in bud entirely glabrous. *Malaya to Sumatra, Java, Sumatra* 24. *P. ottolanderi*
- b. Petioles much shorter, but if over 2 cm long, leaves smaller than 20 by 6 cm and pedicels 1.5—12 mm long 106
- 106.a. Pedicels 1.5—12 mm long. Corolla in bud entirely glabrous. *Malaya to Sumatra, Banka, Java and Borneo* 96. *P. xanthochyllum*
- b. Pedicels 15—27 mm long. Corolla in bud with a few hairs in the middle-line of the outside of the lobes. *Borneo* 10. *P. sericeum*
- 107.a. Secondary nerves (21—)28—35 pairs. Petioles and pedicels woolly or hirsute. *Borneo* 8. *P. beccarianum*
- b. Secondary nerves less than 25, if more than 28 pairs then pedicels and petioles never woolly or hirsute 108
- 108.a. Leaves narrowly elliptic or elliptic-obovate, 7—15 by 2—4.5 cm, narrowed at either end. Secondary nerves 9—13 pairs. Petioles 0.7—1.1 cm, dark brown tomentose. Pedicels 0.4—0.7 cm long, ferruginously tomentose. Stamens c. 1 mm long. *Ceylon* 44. *P. laevifolium*
- b. Leaves in general much broader, often obovate or elliptic, if of the same size than midrib densely woolly below or secondary nerves (10—)13—16 pairs. petioles 1.5—3.5 cm and pedicels 0.7—0.9 cm long. Corolla exsert. Stamens always longer than 1 mm 109

*) No anthers are known of 9. *P. montanum* and this species is included in both items.

**) The pedicels of the flowers in the axil of a leaf should be compared with the petioles of that leaf, as often the pedicels of the lowest flowers are longer than the petioles of the more apical leaves but shorter than the leaf in the axil of which they are inserted.

- 109.a. Leaves obovate or spatulate, sometimes oblong-obovate, 8—15 (—17) by 3.2—6 cm, midrib often woolly below, secondary nerves (10—)13—16 pairs, petioles 1.5—3.5 cm. Sepals ovate-lanceolate, 2.5—4 by 2—3 mm. Fruits globose, obovoid or ovoid, sometimes ellipsoid, 1.8—2.4 by 1.4—1.9 cm, with a distinct finely rugose area around the base of the style. *Sumatra, Malaya* 77. *P. confertum*
- b. Not this combination of characters. Leaves larger. Fruits without a rugose area at apex 110
- 110.a. Secondary nerves 11—14 pairs. Corolla 4—6.5 mm long 111
- b. Secondary nerves 14—33 pairs, but if less then corolla 7—10 mm long . . . 112
- 111.a. Filaments of stamens with long ferruginous hairs. Mature leaves glabrous above. Petioles flat above and crested as well. *Borneo* . . . 40. *P. lisophyllum*
- b. Filaments of stamens glabrous. Mature leaves ferruginously tomentose-hirsute above along midrib, the latter grooved above. *Borneo* . . . 26. *P. ericalyx*
- 112.a. Fruits with a lighter coloured, rugose area at apex 113
- b. Fruits without such an area 114
- 113.a. Secondary nerves 20—25 pairs. Leaves obovate, 20—35 by 9—13 cm. Fruits ellipsoid to subovoid, 2—3 by 1.5—2 cm, surface of embryo smooth. *Borneo* 31. *P. decurrens*
- b. Secondary nerves 17—22 pairs. Leaves subobovate, elliptic or oblong. Fruits obliquely ovoid, 3—3.5 by 1.5—2 cm, surface of embryo deeply irregularly grooved and wrinkled. *Philippines, Moluccas, New Guinea* 70. *P. lobbianum*
- 114.a. Stipules up to 9 mm long, woolly-tomentose on outside. Leaves (14—)20—35 by (5.5—)7—17 cm, woolly-tomentose below. Petioles and pedicels woolly-tomentose. *Malaya* 25. *P. maingayi*
- b. Stipules 1—2 mm long, tomentose or sericeous on outside. Leaves (8—)12—17 (—50) by (2.5—)4.5—6.5 (—12) cm, tomentose or sericeous below. Petioles and pedicels tomentose or sericeous. *Malaya, Sumatra, Borneo and surrounding islands; cultivated elsewhere* 81. *P. gutta*
- 115.a. Filaments of stamens pubescent 116
- b. Filaments glabrous *) 120
- 116.a. Leaf-base rounded to truncate 118
- b. Leaf-base narrowly cuneate 117
- 117.a. Corolla glabrous on either side. Leaves elliptic. *Borneo* 84. *P. ferrugineum*
- b. Corolla ferruginously sericeous on outside. Leaves obovate-oblong. *New Guinea* 71. *P. pseudocalophyllum*
- 118.a. Leaves obovate, 22—28 by 11—12.5 cm, rounded at apex, broadly truncate or cordate at base, brownish hirsute below. Flowers in 7- to many-flowered clusters. Pedicels 4—6 cm long, brownish woolly. *Luzon* . . . 5. *P. abundantiflorum*
- b. Leaves obovate-oblong, ovate, elliptic or obovate, 5—17 by 2.5—6.5 cm, rounded to subacutely acuminate at apex, broadly cuneate to subtruncate or truncate at base. Flowers in 2—4-flowered clusters, pedicels 0.3—3 cm long, sericeous or appressedly tomentose 119
- 119.a. Fruits ellipsoid to obovoid, c. 3.5 by 2 cm, rounded at apex. *Luzon* 9. *P. montanum*
- b. Fruits obovoid, 1.5 by 1.2 cm, rounded and with a rugose area around the remnant of the style. *Bhow, Borneo* 69. *P. rioense*
- 120.a. Leaf-base acute or cuneate 121
- b. Leaf-base rounded 130
- 121.a. **) Apex of fruit smooth 122
- b. Apex of fruit rugose. *Philippines* 60. *P. luzoniense*
- 122.a. Fruits 11 by 9 cm. *Sumatra, Malaya, Batjan (also Celebes and Amboina?)* 38. *P. macrocarpum*
- b. Fruits up to 3.5 by 3 cm 123

*) Unknown in 9. *P. montanum* and this species included under both items.

**) Of 46. *P. cryptocarpiifolium*, 23. *P. supfianum* and 39. *P. vexillatum* no fruits are known but these species can be distinguished as follows:

- 1.a. Secondary nerves 5—10 pairs 2
- b. Secondary nerves 10—16 pairs. *New Guinea* 23. *P. supfianum*
- 2.a. Terminal bud replaced by a flowering shoot. Pedicels 5—8 mm long. Sepals 6, 7 or 8. *Borneo* 46. *P. cryptocarpiifolium*
- b. Terminal bud present. Pedicels 1.5—3 mm long. Sepals 6. *Borneo* 39. *P. vexillatum*

- 123.a. Secondary nerves (10—)17—20(—22) pairs. Pedicels 0.8—1.5 cm long. *Borneo, Celebes* 52. *P. leiocarpum*
 b. Secondary nerves 5—15(—33) pairs. Pedicels 0.2—1.6 cm long 124
- 124.a. Stipules pubescent on either side. Sepals woolly-tomentose on outside. Fruits ovoid, or obovoid to ellipsoid, 1.2—1.8 by 1—1.5 cm. Ovary yellowish appressedly villose. Midrib of leaf grooved above. Anthers longer than the filaments. *Riouw, Borneo* 42. *P. dasyphyllum*
 b. Stipules pubescent on outside only. Sepals tomentose on outside 125
- 125.a. Petioles (0.7—)2—3.5(—6.5) cm long, or fruits up to 3.5 by 3 cm, or ovary glabrous 126
 b. Petioles 0.3—0.9 cm long. Fruits c. 1.8 by 1.3 by 1 cm. Ovary ferruginously villose. Leaves obovate-spathulate, oblong or obovate, 6—12 by 2.5—4 cm, obtuse or obtusely acuminate. Secondary nerves 9—15 pairs. Inflorescences 2—4-flowered clusters or flowers solitary. Pedicels 0.2—0.8 cm long. *Fiji* 15. *P. fidjiense*
- 126.a. Ovary pubescent 127
 b. Ovary glabrous. Fruits pruiniform to globose or obpyriform, up to 2.8 by 2.2 cm. Leaves obovate, oblong-obovate or oblong, 11—25(—45) by 3—7(—17) cm, secondary nerves 8—15(—19) pairs. Petioles (0.7—)1.2—1.7(—3.2) cm long. Inflorescences 4—12-flowered clusters. Pedicels (0.4—)0.9—1.5 cm. *India to Moluccas and Philippines* 1. *P. obovatum*
- 127.a. Corolla glabrous 128
 b. Corolla ferruginously sericeous on outside on tube and base of lobes 129
- 128.a. Stipules lanceolate, 2.5—3 mm long. Fruits glabrous. Midrib of leaves crested above. Outer sepals shorter than the inner sepals. *Celebes* 68. *P. malliense*
 b. Stipules lanceolate, 1—2 mm long. Fruits ferruginously tomentose. Midrib of leaves grooved above. Outer sepals longer than inner sepals. *Malaya, Sumatra, Borneo and surrounding islands; cultivated elsewhere* 81. *P. gutta*
- 129.a. Secondary nerves 5—9 pairs. Fruits ellipsoid, 0.9—1.3 by 0.7—0.9 cm. *Malaya* 33. *P. herveyi*
 b. Secondary nerves 13—17 pairs. Fruits obovoid or obpyriform, 3—3.5 by 1.6—2.3 cm. *Java* 82. *P. tjipetirens*
- 130.a. Ovary glabrous 131
 b. Ovary pubescent 133
- 131.a. Fruits narrowly ellipsoid, often oblique, 4—5 by 1.5—2 cm. Leaves obovate-oblong, obovate or spatulate, 10—17 by 4.5—7.5 cm, apex rounded or cordate. Secondary nerves 10—12 pairs. *Formosa and surrounding islands, Luzon* 16. *P. formosanum*
 b. Fruits ellipsoid to obovoid, up to 3.5 by 2 cm 132
- 132.a. Fruits ellipsoid, c. 1.5 by 1 cm. Leaves elliptic, 7—10 by 2.2—3.5 cm. Secondary nerves 9 or 10 pairs. Petioles 1.5—2.5 cm, narrowly grooved above. Pedicels 0.8—1.2 cm. *Borneo* 43. *P. edenii*
 b. Fruits ellipsoid to obovoid, c. 3.5 by 2 cm. Leaves obovate-oblong or oblong, 8.5—16 by 3.5—6 cm. Secondary nerves 10—13 pairs. Petioles 0.5—1 cm, flat above. Pedicels 1.2—3 cm. *Philippines* 9. *P. montanum*
- 133.a. Secondary nerves 17—25 pairs and pedicels ferruginously woolly pubescent. *Fiji* 80. *P. vitilevuense*
 b. Secondary nerves 9—33 pairs but pedicels never woolly pubescent 134
- 134.a. Corolla glabrous on outside and fruit 2—3.5 by 1—3 cm. *Malaya, Sumatra, Borneo and surrounding islands; cultivated elsewhere* 81. *P. gutta*
 b. Corolla brownish sericeous on outside, sometimes on tube only, or with a few scattered hairs only, but if glabrous then the fruits much larger 135
- 135.a. Corolla brownish sericeous on outside on the entire surface except for the margins of the lobes. *New Guinea* 56. *P. warburgianum*
 b. Corolla glabrous or with a few scattered hairs, or pubescent on outside of tube only 136
- 136.a. Fruit 3.5—6 by 2.5—3 by 1.8—2.3 cm. Corolla with a few hairs only or glabrous. *Sumatra, Malaya, Batjan (also Celebes and Amboina?)* 38. *P. macrocarpum*
 b. Fruit 1.2—1.8 by c. 1 cm. Corolla pubescent on outside of tube only. *Riouw, Borneo* 42. *P. dasyphyllum*

1. *P. obovatum* (Griffith) Engler, Bot. Jahrb. 12, 1890, 511; King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr 16, 1905, 190; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, 5; Dubard, Bull. Mus. hist. nat. 15, 1909, 380; Ridley, Fl. Mal. Pen. 2, 1923, 273; Lam, l. c. 1925, 83, full synonymy; Lam, l. c. 1927, 408; Corner, Wayside Trees Mal., 1951, 601, pl. 182, f. 217; Wyatt-Smith, Research Pamphlet 4, 1954, 38—40, 1 fig. — *Isonandra obovata* Griffith, Not. Pl. As. 4, 1854, 293; Kurz, For. Fl. 2, 1877, 120 — *P. theoides* Elmer, Leaflet. Phil. Bot. 3, 1910, 868, sphalm. *theoides*; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 283; Lam, l. c. 1925, 66; Lam, l. c. 1927, 411 — *P. krantzianum* Pierre ex Lecomte, Fl. Gén. Indo-China 3, 1930 1899 — *P. punctatum* Fletcher, Kew Bull. 1937, 375.

Trees, up to 45 m. Branchlets stout, usually angular, 3—6 mm in diam., pubescence sericeous to tomentose, varicolored, ranging from pale cinnamonous, grey, blackish grey, reddish grey, over pale brown, brown, reddish brown, dark brown, purplish brown, blackish brown to brownish or reddish ferruginous and coppery, soon glabrous; terminal cone up to 18 mm long with the same pubescence as the branchlets; stipules lanceolate or linear, up to 5 by 1.5 mm, apex acute or acuminate, pubescent on outside, glabrous on inside, caducous. *Leaves* conferted or subconferted at apex of branchlets, obovate, oblong-obovate, or oblong, (6—)11—25(—45) by 2.5—7(—17) cm, apex rounded, obtuse or obtusely acuminate, acumen up to 7 mm long, base narrowly to broadly cuneate, decurrent along adaxial side of petiole; generally glabrous above but sometimes sparsely whitish tomentose along the midrib, rarely so over the whole surface, puberulous or tomentose below in the same colours as the branchlets, chartaceous or coriaceous; midrib grooved and minutely crested above, prominent and rounded below, secondary nerves 7—15(—19) pairs, ascending at an angle of 50°—80°, curved but usually straight and curved at their tips only, diminishing until inconspicuous near the margins, grooved, sometimes prominulous and/or crested above, prominent below, tertiary nerves transverse, slender, but usually distinct on either side, sometimes grooved above. Petioles (7—)12—17(—52) mm long, broadly grooved or flat above, pubescent when young, but sometimes soon glabrous. *Flowers* in 4—12-flowered axillary clusters, pedicels angular, (4—)9—20 mm long in flower and fruit, brownish to ferruginously tomentose. *Sepals* triangular or ovate, (1.5—)2.2—3 by (1.5—)2—2.5 mm, apex acute or acuminate, ferruginously or brownish tomentose on outside, glabrous on inside, inner sepals with membranous, fimbriate margins. *Corolla* 10—15 mm long, in bud ferruginously sericeous in alternipetalous lines on the tube and finely ciliate along the margins of the lobes, but soon glabrous, lobes lanceolate-oblong, 6.5—10.5 by 2.5—3.5 mm, apex obtuse, often reflexed in anthesis. *Stamens* (8—)12, 6.5—7.5 mm long, filaments filiform, glabrous, anthers sagittate-ovoid, c. 2.5 mm long, apex acute or acuminate, ferruginously sericeous at the back, dehiscing extrorsely. *Ovary* conoid, gradually passing into the style, c. 2.5 by 1.5 mm, 12-lobed, 6-celled, glabrous. Style filiform, 2—2.5 cm long, glabrous or subpuberulous at the base. *Fruits* pruiniform to globose or obpyriform, up to 2.8 by 2.2 cm, 1- or 2-seeded, apex sometimes with a remnant of the style, pericarp fleshy, glabrous. Seeds ellipsoid, c. 2.5 by 1.2 by 1 cm, acute at either end and sometimes mucronulate, laterally com-

pressed if 2 seeds are present, brown, glossy, scar narrow, c. 20 by 7 mm, brownish, dull, embryo exalbuminous, radicle short, not exsert.

Type specimen. *Griffith 3606* in K.

Vernacular names. Nyatoh by itself is the common name given to this species in Malaya. Others are: Siam: khanun nok chik khao; Indo-China: chây, chor; Langkawi: gutta manjato; Malacca: gëtah nyatoh, gëtah taban, nyatoh bunga, pokok sundek, sebang balang putei; Negri Sembilan: nyatoh mayang; Pahang: bilan, nyatoh kekabu; Selangor: nyatoh balam; Sumatra: ampaloo, balam bunga tjinok, balam sugi sugi, balam terupuh, balam tjupah, majang katapong, natu bulam, njatuh sudu sudu; Celebes: beluwan lika, getah kuma, nato, poto, pudutan, pulutan, p. raindang, p. sela, p. sulat; Amboina: sikki puti; Sumbawa: sadakala; Ternate: tofiri daun ketjil, t. sedang; Luzon: dulitan.

Ecology: Fairly common species of lowland forests, up to 1300 m.

Distribution: India to the Moluccas and Philippines.

Var. *obovatum* — *P. obovatum* (Griffith) Engler, var. *occidentale* H. J. Lam, l.c. 1925, 83, full synonymy.

Leaves obovate or oblong-obovate, apex usually broadly obtuse. Pedicels in anthesis 1.1–1.5 cm long. Stamens 12.

Type specimen: *Griffith 3606* in K.

Distribution: India to Sumatra and Bangka.

BURMA. Moulmein: *Falconer 34* (K, L).

INDIA. f. Lam 1925.

SIAM. Trat, Koh Charug: *Nilkosol 5909* (L), tree, fl. Oct.; Kaw Tao: *Kerr 16028* (K), tree, c. 20 m, fl. buds, Sept., type specimen of *P. punctatum* Fletcher; Bangbao: *Williams 17114* (L), tree 20 m, fl. buds, Feb.; Surathani, Tha Khanaw: *Dinthawng 1673* (BKF), tree, fl. Dec.; Kaw Deng: *Ammandale s.n.* (SING), fl. buds.

INDO-CHINA. Cam chây Mts, Phu Quoi: *Pierre 1423* (BO, L, P), tree 30–40 m, fl. & fr. May, type specimen of *Dichopsis krantziana* Pierre.

MALAYA. Langkawi Isl., Mt Raya For. Res.: *Yahya Shaffi 66436* (KEP), tree 15 m, fl. Nov.; Neor Cook: *Curtis s.n.* (SING), Nov.; State Land: *Din 73615* (KEP, L), tree 20 m, fl. yellow, Oct. — Kedah, Bukit Tanggaa For. Res.: *Din 42142* (KEP), tree 20 m, fl. Jan.; Tampoi For. Res.: *FR 71160* (KEP), tree 13 m, Febr.; Jitra: *Burkill 13350* (A, BO, SING), tree 20 m, fl. March; Pulau Selang: *Corner s.n.* (SING), Nov. — Penang, Botanic Gardens: *Nur s.n.* (SING), Sept.; ibidem: *Nur s.n.* (SING), July — Kelantan, P. Puteh, Semarah State Land: *Rahman 68553* (KEP), tree 17 m, Oct. — Trengganu, Kuala Trengganu: *Holttum 15153* (A, SING), tree 13–16 m, fl. May — Pahang, Rotan Jungle For. Res.: *Osman 29271* (KEP), May — Selangor, Weld Hill For. Res.: *Rahman CF 302* (SING), fl. Jan.; ibidem: *Cubitts CF 854* (SING), fl. Oct.; ibidem: *Rahman CF 1829* (SING), fr. March; ibidem: *Sinclair 40077* (L, SING), fl. Nov.; ibidem: *Rahman 2494* (KEP, SING), fl. Jan.; ibidem: *FR 66453* (KEP), tree 20 m, fl. Sept. — Negri Sembilan, Senawang For. Res.: *Joston 18504* (KEP), April; Sungei Mangala: *Symington 43667* (KEP), April — Malacca, Chaban: *Malvius s.n.* (SING), Sept.; Panchor: *Goodenough 1543* (SING), fl. Oct.; Ayer Panas: *Derry 59* (SING), fr. March; Jasin, Maliman For. Res., alt. 16 m: *Sudin 64156* (KEP), tree 6 m, March; Rini: *Ridley 10079* (SING), fl. Dec.; without loc.: *Malvius 763* (SING), fr. Dec.; *Maingay 985* (K, L), fl.; *Curtis 3480* (SING), fl. May; *Curtis 3481* (SING), fl. May; *Curtis 3482* (SING), May; *Malvius 108* (SING); *Egerton s.n.* (SING), March; *Derry 88* (SING), fl. Nov.; without know loc.: *Griffith 3606* (K), type specimen of *P. obovatum* — Johore, Sungai Bahan, on riverbank in Nibong forest: *Corner 28639* (A, BO, KEP, NY, SING), fl. June; Kota Tinggi — Mawai Road, in drier part of swampy forest: *Corner 21324* (A, BO, KEP, SING), fl. Febr.; Pulau Setindan, Mersing: *Corner s.n.* (SING), gnarled tree up to 10 m, fl. Aug.; Pasang Isl., secondary forest, hillside: *Wyatt-Smith 80552* (KEP, L), tree 23 m, fl. buds, fl. white, Nov. — Singapore, Bot. Gardens: *Ridley 4430* (SING), fl. & fr.; ibidem: *Furtado s.n.* (SING), tree 13 m, fl. Nov.; ibidem: *Henderson s.n.* (SING), fl. Jan.; ibidem: *Nur 1809* (SING),

March; ibidem: *Nur 1900* (SING), March; ibidem: *Kiah s.n.* (SING), fr. Febr.; ibidem: *Nur 1318* (SING), June; ibidem: *Furtado s.n.* (NY, SING), tree 13 m, fl. Nov.; ibidem: *Nur 1489* (SING), March; ibidem: *Nur 1766* (SING), March; ibidem: *Nur 1495 & 1685* (SING), fl. March; Kus island, sea shore: *Peraya 3015* (SING), fl. June; Bukit Timah: *Ngadiman 34653* (BO, SING), fl. Jan.; Changi; *Ridley 2754* (SING), fr.; Pulau Brani: *Ridley 11319* (SING), fl.

LINGGA. f. Lam 1925; Ngina: *NIFS RI/I-13* (BO), tree, Jan.

BORNEO. Sarawak, R. Julan, Usun Apau Plateau, alt. 1000 m: *Pickless 83880* (SING), tree 6 m, Jan.

RIOUW. f. Lam 1925.

BANGKA. f. Lam 1925.

SUMATRA. S. E. C., Medan, alt. 20 m: *NIFS bb 31166* (A, BO, L), fl. buds Jan.

Var. **orientale** H. J. Lam — *P. obovatum* (Griffith) Engler, var. *orientale* H. J. Lam, l. c. 1925, 84, full synonymy — *P. theoidium* Elmer, l. c.

Leaves oblong, apex usually acuminate, sometimes obtuse or rotundate, base acute. *Pedicels* in anthesis 0.9—1.3 cm long. *Stamens* 8—12.

Type specimen: *Teysmann 14178* in BO.

Distribution: Philippines, Celebes, Sula, Buton, Muna, Amboina, Batjan, Ternate, Halmahera, Sumbawa, Aru, Flores.

SEBUYAN. Capiz prov., Mt Giting-giting: *Elmer 12525* (E, FI, L, NY, SING), fl. May, *type specimen* of *P. theoidium* Elmer.

SAMAR. Catubig river: *Ramos 24372* (K), fl. Febr.

LuzON. f. Merrill 1923.

CAMIGUIN. f. Merrill 1923.

CELEBES. Menado, Bolaang Mongondow, Poëpo, alt. 965 m: *NIFS bb 32473* (BO, L), tree 35 m, fl. buds, Sept.; ibidem, Palu, Gimpubia, alt. 400 m: *NIFS bb 17628* (BO), tree; Palopo Morante, alt. 300 m: *NIFS bb 20891* (BO, L), tree, July; Palopo Batang: *NIFS bb 20901* (BO, L), tree, July; Manao, Posa Kalora: *NIFS bb 28725* (BO, L), Aug.; Banggai, Bomban, alt. 200 m: *NIFS bb 31839* (BO, L), juv. fr., Dec.; Minahassa: *Lam 2436* (BO, L), April; Donggala, Alindau, alt. 150 m: *NIFS bb 17639* (BO, L), Aug.; Palu Karopu, alt. 600 m: *NIFS bb 17002* (BO, L), July; ibidem, Tomado, alt. 750 m: *NIFS bb 28214* (BO, L, SING), July; without loc.: *Teysmann 14178* (BO, L), fl.

SULA. Mangoli, mountains N. of Tjapalulu, alt. 100 m: *NIFS bb 29910* (BO, L, SING) — Sanana, Fowata, alt. 150 m: *NIFS bb 28842* (BO, L), Aug.; ibidem: Fowater, Lang Way Bussa, alt. 100 m: *NIFS bb 28843* (BO, L), Aug.

MUNA. Baha, Wasalangka, alt. 10 m: *NIFS bb 21313* (BO, L), tree, Aug.; ibidem: *NIFS bb 21351* (BO, L), tree, Aug.

BUTON. Lagundi: *NIFS bb 13552* (BO), tree 25 m, March.

AMBOINA, TERNATE, HALMAHERA, SUMBAWA. f. Lam 1923.

BATJAN. without known loc.: *Teysmann 5607a* (BO).

ARU. without known loc.: *de Sturber s.n.* (L).

FLORES. Mt Rutang: *de Voogd 1794* (L), May.

2. *P. grande* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 577; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 9; Lam, l. c. 1925, 107, 414; King & Alston, Ann. Roy. Bot. Garden Peradiniya 11, 3, 1930, 293, 296, pl. 40 f. 1 — *Isonandra grandis* Thwaites, Enum., 1864, 176 — *Bassia grandis* (Thwaites) Beddome, Fl. Sylv. 2, 1869—1873, t. 254 — *Dichopsis grandis* (Thwaites) Benthham, Gen. Pl. 2, 1876, 658; Clarke in Hooker f., Fl. Br. India 3, 1882, 540.

Trees. Branchlets 2—7 mm in diam., densely dark brown tomentose, glabrescent; terminal cone broadly ovoid, up to 2 by 5 mm, tomentose; stipules ovate, c. 1.5 by 1 mm, acute at apex, whitish tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, obovate or elliptic, 12—27 by 5—13.5 cm, apex rounded, rarely short obtusely acuminate, base broadly

or narrowly cuneate, shortly decurrent; greyish puberulous above but soon glabrous, glabrous below, subcoriaceous; midrib grooved and minutely crested above, prominent and rounded below, secondary nerves 11—13 pairs, ascending at an angle of 60° — 65° , curved, archingly joined, sometimes only faintly so, prominulous above, prominent below, tertiary nerves transverse but outnumbered by the reticulate nervation in between, inconspicuous above, distinct below. Petioles 1.5—2.5 cm long, flat above, rounded below but slightly flattened as well, ferruginously tomentose and rugulose below. *Flowers* in 4—7-flowered, axillary clusters on warts below the leaves, pedicels terete, thickened at apex, 1.5—2.2 cm long, ferruginously tomentose, thicker in fruit. *Sepals* lanceolate, 4—8 by 2—4 mm, apex acute, ferruginously tomentose on either side, base of inner sepals membranous and fimbriate. *Corolla* up to 13 mm long, glabrous, lobes elliptic-lanceolate, 8—10 by 2—2.5 mm, apex truncate or obtuse. *Stamens* 12, 9—12 mm long, filaments 6—8.5 mm long, glabrous except for a few hairs at the base, anthers oblong, 3.5—4 mm long, apex bifid, dehiscing extrorsely, glabrous. *Ovary* subglobose, c. 2 mm in diam., 6 celled, sparsely ferruginously hirsute. Style filiform, up to 22 mm long, glabrous. *Fruits* ovoid, 14—17 by 12—13 mm, 1-seeded, glabrous, at apex with a remnant of the style which is circularly broadened at its base, pericarp thin, glabrous; seeds incompletely known.

Type specimen: *Thwaites* 619 in K.

Vernacular names: Ceylon: meeria-gass, kiripedda.

Use: An oil is extracted from the seeds and is used medicinally, and when fresh, for cooking (f. Thwaites).

Ecology: In forests at medium altitudes.

Distribution: Ceylon.

CEYLON. Central Provinces and Saffragam Distr., alt. 1000—2000 m: *Thwaites* 619 (BO, CAL, G, K, US), fl. & fr.

3. *P. stehlinii* Christophersen, B. P. Bish. Mus. Bull. 128, 1935, 168, f. 24; Lam, *Blumea* 5, 1, 1942, 34.

Trees c. 15 m. Branchlets stout, c. 10 mm in diam., ferruginously puberulous, glabrescent; terminal cone up to 5 mm long, puberulous; stipules not seen. *Leaves* conferted at apex of branchlets, oblong-elliptic, 19—32 by 10—14.5 cm, apex obtusely acuminate, acumen up to 7 mm long, base broadly cuneate, sometimes oblique, shortly decurrent; entirely glabrous, chartaceous; midrib grooved and with 2 minute crests, prominent below, secondary nerves 10—12 pairs, ascending at an angle of c. 60° , grooved above, prominent below, curved near margin and diminishing until inconspicuous, tertiary nerves slender, transverse, distinct on either side. Petioles 3.5—6 cm, flat or grooved above, sparsely whitish puberulous or glabrous. *Flowers* in 2—3-flowered, axillary clusters or solitary, pedicels angular, 3.5—4.5 cm long, ferruginously tomentose. *Sepals* ovate-triangular, 5—6 by 3.5—4.5 mm, apex obtusely acuminate, the inner ones obtuse, ferruginously puberulous on outside but glabrous along the membranous margins and on inside. *Corolla* 12—14 mm long, glabrous, tube c. 2 mm long, lobes lanceolate, 10—12 by 3—4 mm. *Stamens* 12 (or more?), 6—7 mm long, filaments filiform, 2.5—3 mm long, glabrous, anthers oblong-ovoid,

4—5 mm long, apex acute, ferruginously hirsute, dehiscing laterally. *Ovary* ovoid, 3—5 by 2.5—3.5 mm, 6-celled, 6-lobed, pale yellowish hirsute. *Style* subulate, up to 3 cm long, grooved, glabrous or subglabrous, in the withered flowers up to 4 cm long. *Fruits* obliquely fusiform, c. 5.5 by 2.5 by 1 cm, 1-seeded, acute at apex, rounded at base, pericarp thin, fleshy, glabrous. *Seeds* fusiform, c. 3.5 by 1.5 by 0.7 cm, pointed at either end, pale orange, scar dull grey, covering about half of the seed, embryo exalbuminous, radicle short, exsert.

Type specimen: *Christophersen 3255* in BISH.

Vernacular name: ngasu (Savaii).

Use: The wood is said to be used for houseposts.

Ecology: In foothill forests at low altitude.

Distribution: Samoa (Savaii), Fiji (Vanua Levu).

SAVAII. Forest above Sili, alt. 300 m: *Christophersen 3255* (BISH, BO, L), tree 15 m, fl. Nov.; NW of Sili: *Vaupel 341* (B, L), fr. May.

FUJI. Vanua Levu, Mathuata, summit ridge of Mt Numbuiloa, east of Lambasa, alt. 500—590 m, dense forest: *A. C. Smith 6508* (L, US), tree 4 m, fr. Oct./Nov.

4. *P. oxyspermum* H. J. Lam, *Blumea* 5, 1, 1942, 34, f. 7.

Trees up to 25 m. Branchlets angular, 3—5 mm in diam., glabrous, terminal cone and stipules not seen. *Leaves* scattered, ovate or elliptic, 9—15 by 4—7 cm, obtuse or obtusely acuminate at apex, base cuneate, shortly decurrent; chartaceous, glabrous on either side; midrib minutely crested above, prominent below, secondary nerves 5—7 pairs, ascending at an angle of c. 60°, curved, grooved above, prominent and angular below, diminishing until inconspicuous near margin, tertiary nerves slender, transverse, distinct on either side. Petioles 1.5—3.5 cm long, flat, minutely crested in the apical part, glabrous. *Flowers* and *fruits* unknown. *Seeds* obliquely oblong-ellipsoid, 5.8—7 by 2—2.5 cm, apex acutely rostrate and somewhat flattened, base obtuse, testa thick, woody, nitidous, scar covering almost the entire seed leaving free only a linear, 5—7 mm broad part of the testa, embryo exalbuminous, cotyledons very thick, radicle acute, inferior. Pedicel of fruit stout, 2.7—2.8 cm long, glabrous.

Type specimen: *Christophersen 2884* in L.

Ecology: In forests at medium altitudes.

Distribution: Samoa (Savaii, Upolu).

SAVAII. Le To, Salailua, in forest, alt. 750 m: *Christophersen 2884* (BISH, L), tree 25 m, fr. Oct.

UPOLU. Malololelei, alt. 700 m, forest: *Christophersen 29* (BISH, L), tree, fr. Aug., not ripe.

5. *P. abundantiflorum* H. J. Lam, l. c. 1925, 61, f. 11; Lam, l. c. 1927, 37 — *P. barnesii* (non Merrill, 1903) Merrill, *Enum. Ph. Fl. Pl.* 3, 3, 1923, 278.

Trees? Branchlets stout, blackish brown woolly, glabrescent; terminal cone c. 12 mm long, blackish brown woolly; stipules lanceolate, up to 7 by 2 mm, apex acute, greyish brown woolly on outside, glabrous on inside, caducous. *Leaves* conferted at apex of branchlets, obovate, 22—28 by 11—12.5 cm, apex rounded, base broadly truncate or cordate; glabrous above, sparsely brownish hirsute below, thin-coriaceous; midrib grooved above and minutely crested, angular below, secondary nerves 12—14 pairs,

ascending at an angle of c. 60° , grooved above, prominent below, straight, curved at the tips, diminishing until inconspicuous near margin of leaf, sometimes archingly joined, tertiary nerves slender, transverse, inconspicuous above, prominulous below. Petioles stout, 12–15 mm long, brownish woolly pubescent. *Flowers* in 7- to many-flowered clusters, axillary, pedicels angular, 4–6 cm long, brownish woolly pubescent. *Sepals* triangular, broadly rotundate-ovate or rotundate, 3–3.5 by 2.5–3.5 mm, apex acute or acutely acuminate, greyish brown woolly on outside, glabrous on inside, inner sepals up to 4.5 by 4.5 mm, apex obtuse, margins membranous, sericeous on outside, glabrous on inside. *Corolla* up to 12 mm long, ferruginously sericeous on outside (according to Lam glabrous), glabrous on inside, lobes elliptic-ovate, up to 9 by 4 mm, apex acute, deflexed in flower. *Stamens* 12, c. 8 mm long, filaments filiform, broadened at base, 4–4.5 mm long, sparsely ferruginously sericeous, anthers oblong, 2–4 mm long, apex mucronate, dehiscing extrorsely, ferruginously sericeous on either side. *Ovary* globose, c. 2 by 2 mm, pale ferruginously sericeous (according to Lam glabrous), 6-celled. Style filiform, 7–15 mm long, sericeous at the base. *Fruits* unknown.

Type specimen: *Barnes 168* in PNH.

Lectotype specimen: *Barnes 168* in SING.

Distribution: Luzon.

LUZON. Bataan prov., Lamao river: *Barnes 168* (SING), fl. Jan.

6. *P. clarkeanum* King & Gamble, J. As. Soc. Bengal 74, 2, Extra Nr. 17, 1905, 191; Ridley, Fl. Mal. Pen. 2, 1923, 274; Lam, l. c. 1925, 106; Heyne, Nutt. Pl. Ned.-Ind., ed. 2, 2, 1927, 1233; Lam, l. c. 1927, 403; Heyne, l. c., ed. 3, 1, 1950, 1233; Wyatt-Smith, Research Pamphlet 4, 1954, 31 — **Fig. 1.**

Trees, up to 50 m. Branchlets terete, 5–12 mm in diam., brownish or ferruginously woolly when young, glabrescent; terminal cone up to 9 mm long, woolly; stipules lanceolate, up to 9 by 2.5 mm, apex acute, woolly on either side, soon caducous. *Leaves* scattered, obovate or obovate-oblong, (12–)17–25(–32) by (6.5–)10–12.5(–14.5) cm, obtuse or retuse (see, however, also under dubious specimens) at apex, base broadly cuneate, sometimes subrotundate; immature leaves scattered ferruginously woolly above, mature ones glabrous except along midrib and sometimes along secondary nerves as well, underside of leaf in all stages ferruginously woolly-tomentose, chartaceous; midrib grooved above, prominent and ribbed below, secondary nerves 17–23 pairs, ascending at an angle of 70° – 80° , straight, curved at their tips only, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nervation transverse, slender, inconspicuous above, prominent below. Petioles 1.6–3.5 cm long, grooved above (and sometimes minutely crested?), rounded below with a few shallow grooves, widened at base, ferruginously woolly-tomentose. *Flowers* in 4–9-flowered, axillary clusters, pedicels angular, 3–4.5 cm long, densely ferruginously woolly-tomentose. *Sepals* ovate or ovate-rhombate, 5–7.5 by 5–6.5 mm, apex obtuse or subacute, dorsally broadly crested, ferruginously or brownish woolly-tomentose on outside, glabrous on inside, inner sepals narrowed, with membranous and glabrous margins, fimbriate. *Corolla* 12–14 mm long, glabrous except for a narrow bundle of hairs



Fig. 1. *P. clarkeanum*, a. branchlet with leaves, pubescence on underside of leaves partly drawn; b. branchlet with flowers; c. tertiary nervation of leaf (Karangan 31220).

in the middle-line on the outside of the tube and base of the lobes, lobes oblong-elliptic, 9—10 by 2.5—3.5 mm, subobtus. *Stamens* 12—15, 7—8 mm long, filaments filiform, 5—6 mm long, glabrous, anthers oblong, 2.5—3 mm long, acute or bifid at apex, dehiscent introrsely, glabrous. *Ovary* ovoid, 6-celled, c. 1 by 1.5 mm, sparsely ferruginously hirsute, at base with a 12-lobed disk. Style filiform, 11—15 mm long, glabrous. *Fruits* not seen but according to King & Gamble: "oblong, glossy, c. 5 cm long, 1-seeded, seeds acute at both ends, rounded on the back, flattened at the hilum, c. 3 cm long, testa thin, chartaceous, hilum oblong, cotyledons oblong, fleshy."

Type specimen: *King's Collector 3796* in K.

Vernacular names: gëtah gëtapang, taban ketapang, nyatoh ketiar (Malayan language).

Ecology: Uncommon tree of lowland hill forest.

Distribution: Malaya.

MALAYA. Penang, Larut: *King's Coll. 3796* (K), fr. Jan., *ex litt.* — Kedah, Bongsu For. Res.: *Karangan 31220* (KEP), tree 25 m, fl. Dec. — Kelantan, Bunga Raya: *Hamid 33415* (KEP), April — Perak, Waterfall Hill: *Wray 530* (SING); Ulu Laut Lenggong: *Hamid 10353* (KEP, SING), July; Bubu For. Res.: *Symington 30719a* (KEP), April — Pahang, Baloh For. Res.: *Lajis 6843* (KEP), Nov.; Kemansul For. Res., Temerloh: *Hamid 10582* (KEP), Sept. — Negri Sembilan, Triang For. Res.: *Mohammed 18801* (KEP), tree 40 m, fl. July; Pasoh For. Res., Kuala Pilah: *Jaamat 46073* (KEP), Febr.; Tampin Hill: *Ridley 13050* (?) (SING), Jan. — Malacca, Kuantan, Bukit Goh For. Res.: *Ismail 17310* (KEP, SING), Febr.; Bt Bintang Hijam For. Res.: *Kangsar 30326* (KEP), tree 20 m, fl. Febr.; Kuala Lumpur, Lig Club: *Pani 7045* (KEP), tree 20 m, fl. white, Febr.

Dubious specimens: *Foenander 23041* (KEP), July; *Burn-Murdock 10821* (KEP); *Kehding 126* (FI), Dec.; *Corner 25554* (SING), June.

These specimens are sterile, have large leaves with a smaller number of secondary nerves, acuminate tips and long internodes on the branchlets. It is suspected that they represent watersprouts, and owing to the lack of flowers and fruits it is difficult to state the true status of these specimens.

7. *P. hispidum* H. J. Lam, l. c. 1925, 63, f. 12; Heyne, Nutt. Pl. Ind. ed. 2, 2, 1927, 1236; Lam, l. c. 1927, 400; Heyne, l. c., ed. 3, 1, 1950, 1236 — *P. hispidum* H. J. Lam, var. *typicum* and var. *grandiflorum* H. J. Lam, l. c. 1925, 65; idem, l. c. 1927, 400.

Trees, up to 50 m. Branchlets terete, 5—8 mm in diam., pale or brown yellowish woolly hirsute, soon glabrous; terminal cone up to 12 mm long, woolly hirsute; stipules lanceolate, up to 12 by 5 mm, apex obtuse, pale or yellowish brown woolly-hirsute on outside, ferruginously so on inside. *Leaves* subconferted near apex of branchlets, ovate or ovate-oblong, or subovate, 12—27 by 5—13 cm, apex obtuse and short obtusely acuminate, acumen up to 5 mm long, base broadly cuneate to rounded and sometimes unequal, almost not decurrent; glabrous above but sometimes hirsute on midrib, underside ferruginously or yellowish hirsute, denser so on nerves and midrib, coriaceous; midrib grooved above, often with a narrow groove in the middle of the larger groove, prominent and rounded below, secondary nerves slender, 20—28 pairs, ascending at an angle of c. 50°, in the basal part up to 90°, slightly curved or straight and curved at their tips only,

diminishing until inconspicuous near margin, or subarchingly joined by thickened tertiary nerves, minutely grooved above, prominent below, tertiary nerves slender, transverse, inconspicuous above and often grooved, more distinct below and prominulous. Petioles 2—4.5 cm long, narrowly grooved above, densely yellowish or brownish hirsute. *Flowers* in 7—25-flowered, axillary clusters, pedicels 2—4 cm long, in fruit usually stouter but not prolonged, densely hirsute. *Sepals* ovate, triangular, or subelliptic, 4.5—10 by 5—8 mm, apex subacute, obtuse or rounded, ferruginously tomentose on outside, glabrous on inside, outer sepals sometimes dorsally slightly crested, inner sepals more rotundate, with membranous and fimbriate margins. *Corolla* 7—18 mm long, ferruginously sericeous on the tube and the base of the lobes only, for the rest glabrous, lobes broadly elliptic or ovate, 5—14.5 by 3.5—4.5 mm, apex rounded, fimbriate. *Stamens* 12, entirely glabrous, 4.5—5.5 mm long, filaments filiform, angular, 2.5—3 mm long, anthers oblong, 3—3.5 mm long, apex bifid, dehiscing extrorsely. *Ovary* ovoid, c. 2 by 2 mm, 6-celled, yellowish or brownish hirsute. Style filiform, angular, up to 10 mm long, in fruit 20—30 mm long, glabrous. *Fruits* globose or ellipsoid, 20—25 by 12—20 mm, 1- or 2-seeded, apex rounded or obtuse, often with a short remnant of the style, pericarp hard-fleshy, glabrous. Seeds ovoid, 15—18 by 10—12 mm, laterally flattened in the 2-seeded fruits, apex obtuse, base subacute, testa cartilaginous, yellowish brown, nitidous, scar covering slightly more than $\frac{1}{3}$ of the surface of seed, brownish, dull, embryo exalbuminous, radicle subexsert.

Lectotype specimen: *van Delden s.n.* in L.

Vernacular names: Perak: nyatoh; Selangor: mersokong; Malacca: nyatoh tembaga; Sumatra: majang sërikat; Borneo: nyatog puang.

Ecology: In primary rainforests at low altitudes.

Distribution: Sumatra, Malaya, Borneo.

SUMATRA. Sumatra East Coast, Langkat: *Heyne 891* (BO).

MALAYA. Selangor, Kuala Lumpur, Bukit Kubu Res., K. Kubu: *Browne 14364* (KEP), tree 50 m, April, buttressed; ibidem, Subang For. Res.: *KEP 64964* (KEP), March (*dubious specimen*); Ulu Zangat For. Res., low ridge, 200 m: *KEP 71383* (KEP), tree 40 m, Aug.; Kepong, edge of jungle, alt. 130 m: *KEP 56317* (KEP), tree 7 m; Ulu Langat, Sungai Latang For. Res.: *KEP 53603* (KEP), tree, Aug. — Pahang, Bintong, Lintang For. Res., alt. 160 m: *KEP 57904* (KEP), tree 40 m, Nov.; Kuala Lipis: *van Delden s.n.* (BO, L), fl. & fr. Febr. — Kedah, Kokmoi For. Res.: *KEP 47847* (KEP), tree 25 m, fr. Aug.; Poto Tirie: *Curtis s.n.* (SING), very large tree, juv. fr. Sept. — Malacca, Sungai Udang Res.: *CF 2009* (SING), fr. Aug. — Kemaman, Bukit Kajang, alt. 160 m: *Corner SF 30592* (SING), fl. fr. Nov.

BORNEO, Sarawak, without loc.: *Foxworthy 499* (BO), fl. white, July, *type specimen of var. grandiflorum* H. J. Lam.

8. *P. beccarianum* (Pierre) van Royen, *Blumea* 8, 2, 1957, 424 — *Croixia beccariana* Pierre, *Not. bot. Sapot.*, 1890, 33 — *Planchonella beccariana* (Pierre) H. J. Lam, l. c. 1925, 216; Lam, l. c. 1927, 382, 475 — *Planchonella pierreana* Dubard, *Ann. Mus. col. Mars.* 20, 1912, 60 — *Palaquium ferox* H. J. Lam, l. c. 1925, 70, 256, f. 17; Lam l. c. 1927, 401.

Trees, c. 20 m. Branchlets stout, irregularly terete by the numerous leaf-scars, 8—17 mm in diam., densely reddish brown or blackish woolly or hirsute; terminal cone up to 18 by 12 mm, densely woolly or hirsute; stipules lanceolate-oblong, up to 2.5 by 1 mm, apex obtuse, woolly on

outside, glabrous on inside, very soon caducous. *Leaves* oblanceolate, but usually obovate-oblong or obovate, 12–30(–37) by 4–9(–14) cm, apex rounded and acutely or obtusely acuminate, acumen up to 8 mm long, base narrowly acute to subrotundate, not decurrent; coriaceous, glabrous above, densely light or dark brownish or ferruginously woolly or hirsute below, very rarely subglabrous below; midrib grooved above and minutely crested, prominent and rounded below, secondary nerves (21–)28–35 pairs, ascending at an angle of 50°–70°, straight or slightly curved, archingly joined near margin, grooved above and markedly prominent below, the arches between the nerves also grooved above and distinctly prominent below, tertiary nerves transverse, grooved above, prominent below but there often covered by the dense pubescence. Petioles 1–4.5 cm long, densely dark greyish, light brownish, or light or dark ferruginously woolly, grooved above but the groove hidden by the pubescence. *Flowers* in 5–8-flowered, axillary clusters, pedicels angular, 5–9 mm long, in fruit up to 25 mm long, ferruginously or greyish woolly or hirsute. *Sepals* ovate-oblong, ovate or lanceolate, 3.5–5 by 3–4.5 mm, in fruit up to 6 by 5 mm, apex of outer sepals obtuse, the inner ones with acute apex, woolly on outside, glabrous on inside. *Corolla* 8–10 mm long, glabrous except ferruginously tomentose on the outside in the middle-lines of the lobes, the latter ovate to elliptic, 5–6.5 by 2–3 mm, apex obtuse. *Stamens* (10–)12, glabrous, 7–10 mm long, filaments filiform, 6–8 mm long, anthers narrowly ovoid, 2–2.5 mm long. *Ovary* discoid-conoid, c. 1 by 1.5 mm, 6-celled, glabrous. Style subulate, 14–18 mm long, glabrous. *Fruits* ellipsoid, 2.5–3 by 1.5–1.8 cm, apex obtuse, 1-seeded, pericarp fleshy, glabrous. Seeds ellipsoid to subglobose, sometimes laterally compressed, 2–2.5 by 1.4–1.8 by 1–1.3 cm, mucronate at apex, obtusely acuminate at base, testa thin, blackish, nitidous, scar covering about half of the seed, dull greyish, embryo exalbuminous or with a slight remnant of it at its base, radicle exsert.

Type specimen: *Beccari 4069* in P.

Vernacular names: asam babi, asam megkujut, bindjai babi, karikit, njato, njatu tingang, puntik, tengkawang.

Distribution: Borneo.

Sandakan. Sepilok, primary forest, low alt.: *Agama A1809* (K, KEP, L, SING), tree 20 m, Sept., buttresses low and sharp; ibidem: *Agama SAN 17670* (L, SAN), tree, fl. May; ibidem, lowland forest: *Sinclair c.s. 9319* (L, SAN), tree, June — Sarawak, without loc.: *Beccari 733* (P), fr. Nov.; Mattang: *Beccari 4069* (FI, P), fr. Dec.; Kuching: *Beccari 34* (FI) — W. Borneo, Sintau, near Bungkung, B. Saguk, alt. 150 m: *NIFS bb 32289* (BO, L), May; Sungei Kuwatan, alt. 25 m: *NIFS bb 2610* (BO, L), April — S. W. Borneo, East Kutai, low hills, alt. 40 m, sandy soil: *Kostermans 7244* (BO, L), tree 20 m, fr. green, June; Martapura, Rantau Balai, alt. 50 m: *NIFS bb 8208* (BO, L), March; Martapura, Djungur: *NIFS bb 10410* (BO, L), Sept. — S. E. Borneo, Loa Djanan, west of Samarinda, alt. 30 m, ridge with sandy loamy soil: *Kostermans 6714* (BO, L), tree 20 m, fr. green, April, white latex; Sepaku near Balikpapan: *NIFS bb 24644* (BO, L), June; Sungei Menubar, alt. 10 m: *Kostermans 5401* (BO, L), tree 16 m, June; Bulungan, Nunukan, alt. 3 m: *NIFS bb 26142* (BO, L), June; ibidem: *NIFS bb 29316* (BO, L), May; Long Bleh, Sei Sentakan, alt. 50 m: *NIFS bb 29599* (BO, L), Oct.; Berau Damarang, alt. 50 m: *NIFS bb 18818* (BO, L), May; Tidung Lands, alt. 15 m: *NIFS bb 17801* (BO, L), Aug.; Palawan, alt. 75 m: *NIFS bb 11908* (BO, L), Sept.; Sebulu, alt. 20 m: *NIFS bb 15795* (BO, L), Oct.; Kophiang: *van Romburgh 36* (BO, L), Sept.; Kutai, Sungei Tapianlobang: *NIFS bb 12568* (BO, L), June; Purutjahu, Muara Djaan, alt. 100 m: *NIFS bb 10480* (BO, L), Oct.; Sabintulung: *NIFS bb 15849* (BO, L), Oct. — E. Borneo, without

loc.: *Teysmann s.n.* (BO, L), type specimen of *Planchonella pierreana* Dubard and *Palaquium ferox* H. J. Lam.

Remark. Lam's supposition that *P. sambasense* might be synonymous to *P. ferox* (= *P. beccarianum*) is hardly justified as the two species differ in the number of secondary nerves which is 16—20 pairs in the former and 30—35 pairs in the latter and in the ferruginous pubescence of the lower side of the leaves in *P. ferox* against the brownish pubescence in *P. sambasense*.

9. ***P. montanum*** Elmer, Leafl. Phil. Bot. 8, 1919, 3102; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 281; Lam, l. c. 1925, 59; Lam, l. c. 1927, 400.

Trees. Branchlets stout, 2.5 mm in diam., greyish ferruginously sericeous, glabrescent; terminal cone up to 10 mm long, greyish sericeous; stipules lanceolate, up to 6 by 2 mm, apex acute or acuminate, pubescent on outside, glabrous on inside. *Leaves* conferted at apex of branchlets, obovate-oblong or oblong, 8.5—16 by 3.5—6 cm, apex rounded to subacutely acuminate, acumen up to 3 mm long, base rounded to truncate; glabrous above, brownish or greyish velutinous below, rigidly coriaceous; midrib minutely crested above, prominent and rounded below, secondary nerves 10—13 pairs, ascending at an angle of 55°—65°, slightly curved, diminishing until inconspicuous near margins of leaf, prominulous and grooved above, prominent below, tertiary nerves very slender, transverse, inconspicuous on either side. Petioles stout, 5—10 mm long, flat above, pale greyish brown tomentose. *Flowers* solitary or in 2—4-flowered clusters, axillary, pedicels angular, 12—30 mm long, pale cinnamomously sericeous. *Sepals* triangular, 3—4 by 2—3 mm, outer sepals subacute or obtuse at apex, inner sepals acute at apex and with membranous margins, greyish cinnamomous on outside, glabrous on inside. *Corolla* not seen, but according to Elmer lobes nearly twice as long as the calyx, obovately oblong, apex obtuse or obtusely rounded, narrowed towards the base or subelawed, 4 mm wide, glabrous. *Stamens* not seen, but according to Elmer 10—12, filaments 2—3 mm long, anthers at least as long as the filaments, large, compressed, ovately elongate, 1 mm wide, the connective thick and extended into a minute point, laterally dehiscent. *Ovary* ovoidly globose or conoid, c. 2 by 2.5 mm, 6-celled, glabrous. Style stout, up to 11 mm long, glabrous. *Fruits* ellipsoid to obovoid, c. 3.5 by 2 cm, 1-seeded, apex rounded, pericarp fleshy, glabrous. Seeds incompletely known, probably fusiform, c. 2.5 by 0.8 cm, blackish, dull, scar probably covering half the seed.

Type specimen: *Elmer 17189* in PNH.

Lectotype specimen: *Elmer 17178* in L.

Ecology: In mossy forests at c. 1100 m altitude.

Distribution: Luzon, Mindanao.

LUZON. Laguna prov., Mt Maquiling: *Elmer 17189* (FI, G, L, NY, S), fl. & fr. June; ibidem: *Baker 2872* (f. Merrill).

MINDANAO. Davao prov., Mt Apo: *Elmer 11816* (BO, E, FI, G, L), fl. Sept.

Remark. This species closely resembles *P. lisophyllum*.

10. ***P. sericeum*** H. J. Lam, l. c. 1925, 53, f. 9; Lam, l. c. 1927, 399. Trees? Branchlets slender, 1—3 mm in diam., ferruginously or greyish

sericeous or tomentose; terminal cone up to 5 mm long, dark brown ferruginously woolly; stipules linear, up to 9 by 2 mm, acuminate-acute, ferruginously pubescent on outside, glabrous on inside, persisting, but in the oldest leaves absent. *Leaves* scattered, oblong to obovate, (13—)18—24(—31) by (5—)6.5—12.5 cm, apex acutely or obtusely acuminate and sometimes emarginate, base rounded, sometimes slightly oblique; pale ferruginously sericeous above when young, mature glabrous above, minutely pale golden-coloured to silvery sericeous-tomentose below, but slightly darker on the nerves, subchartaceous; midrib grooved above, prominent and angular or rounded below, secondary nerves (13—)17—24(—27) pairs, ascending at an angle of 50°—60°, slightly curved or straight and curved at tips only, diminishing until inconspicuous near margin, near apex of leaf sometimes archingly joined, impressed above, prominent below, tertiary nerves transverse, hardly visible above, inconspicuous below. *Petioles* stout, 5—12 mm long, flat above, pale ferruginously tomentose. *Flowers* in (2—)7—10-flowered clusters, sometimes in 2 groups, axillary, pedicels angular, 1.5—2.7 cm, in fruit up to 4 cm long, ferruginously appressedly tomentose. *Sepals* deltoid or ovate, 2.5—4.5 by 2—3 mm, apex of outer sepals acute, of inner sepals acute, obtuse or rounded, ferruginously tomentose on outside, glabrous on inside, inner sepals with membranous and scarious margins, whitish or pale ferruginously tomentose on outside, glabrous on inside. *Corolla* 6—9 mm long, in bud glabrous except for a few hairs in the middle-line of the outside and the apex of the lobes, tube 1.5—3 mm, lobes ovate-lanceolate, 4.5—6 by 1.5—2.5 mm, apex subobtuse. *Stamens* 12, glabrous, filaments subulate, angular, up to 0.6 mm long, glabrous, anthers sagittate, 2.5—3.5 mm long, apex long acutely acuminate, glabrous, sometimes bifid, outer stamens dehiscing extrorsely, the inner whorl introrsely. *Ovary* conoid, c. 1 by 2 mm, sparsely ferruginously tomentose, gradually tapering into the glabrous, filiform, up to 8 mm long style. *Fruits* globose, c. 1 cm in diam., or ellipsoid, sometimes oblique and then up to 2.6 by 1.6 cm large, sparsely pubescent but finally glabrous. Seeds unknown.

Type specimen: *Jaheri 716* in BO.

Distribution: Borneo.

Var. **sericeum** — *P. sericeum* H. J. Lam, var. *acutocalyx* H. J. Lam, l. c. 1925, 55, f. 9, a—f.

Leaves 24—41 by 6.5—10.5 cm. *Petioles* 1.1—1.2 cm long. Secondary nerves 24—27 pairs. *Pedicels* 1.6—2 cm long, in fruit 3—4 cm long. Inner and outer whorl of sepals acute. *Corolla* 7.5—9 mm long.

Type specimen: *Jaheri 716* in BO.

Ecology: In primary and secondary forests at low altitudes.

Distribution: Borneo.

BORNEO. Sarawak, Rejang: *Haviland 2030* (BM, K, SING), fl. March; Hutau Merit: *Daud & Tachun 35705* (SAR, SING), tree 8 m, fr. Aug., green; Sungei Tau, alt. 100 m, secondary forest: *Purseglove P 5423* (L, SING), tree 8 m, fl. June — Indonesian Borneo, Bloeloe: *Jaheri 716* (PO), fl. & fr.; Sungaibrunai: *Jaheri 1321* (BO), fl.; Sungaimagne: *Jaheri 1573* (BO), fl.

Var. **obtusocalyx** H. J. Lam — *P. sericeum* H. J. Lam, var. *obtusocalyx* H. J. Lam, l. c. 1925, 55, f. 9, g—h.

Leaves c. 18 by 8.5 cm. *Petioles* 5—9 mm. Secondary nerves (14—)

17—18 pairs. Pedicels 2—2.7 cm. Outer whorl of sepals acute, those of the inner whorl obtuse. *Corolla* c. 7.5 mm.

Type specimen: *Haviland & Hose 624* in BO.

Ecology: In forests at low altitudes.

Distribution: Borneo.

BORNEO. Sandakan, Miri: *Haviland & Hose 624* (BM, BO), fl. April; Kapit, Upper Rejang river: *Clemens & Clemens 21114* (BO), tree 5 m; Gat, Upper Rejang river: *Clemens & Clemens 21534* (BO), tree, fl. — Indonesian Borneo, Sepan: *NIFS bb 26381* (BO, L, SING), fl. Nov.

11. *P. elegans* K. Griffioen & H. J. Lam, n. sp. — Fig. 2.

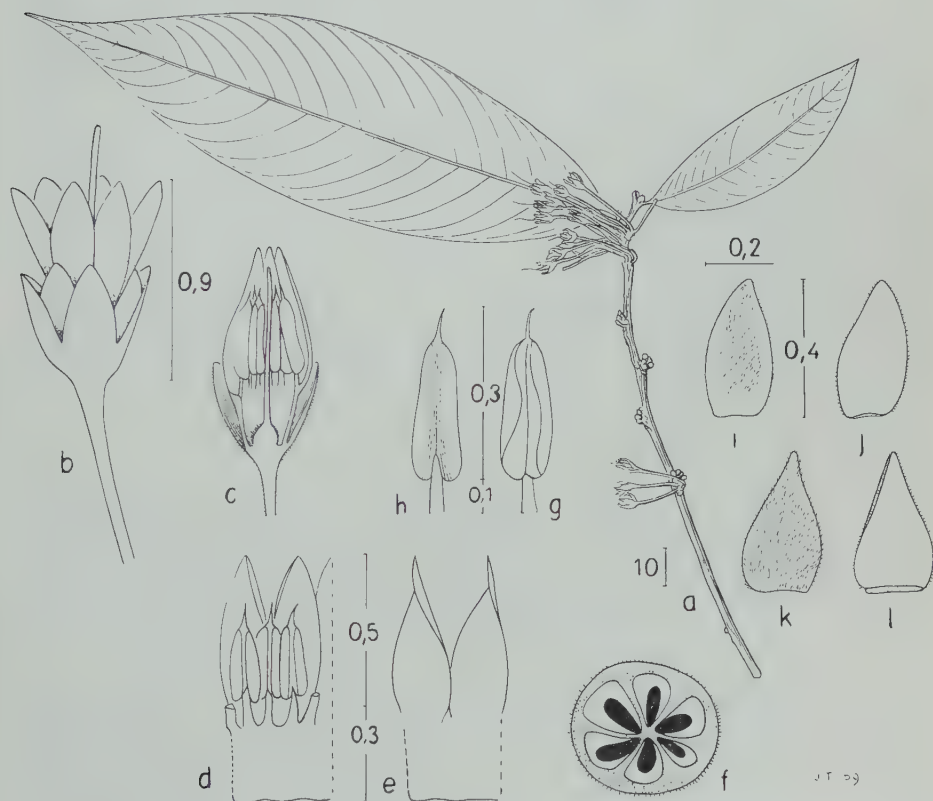


Fig. 2. *P. elegans*, a. branchlet with leaves and flowers; b. flower; c. flower, opened; d. part of corolla, inside; e. part of corolla, outside; f. transverse section of ovary; g-h. stamens; i. inner sepal, outside; j. inner sepal, inside; k. outer sepal, outside; l. outer sepal, inside (*Haviland 898/801*).

Arbor parva. Ramuli graciles, ferrugineo-sericei, glabrescentes; stipulae lanceolatae, acutae, caducae. Folia anguste elliptica, 13—17 × 4—6 cm, longe acute acuminata, utroque latere cinnamomeo subsericeo-tomentosa, sed maturate supra glabra. Nervi secundarii utroque latere 17—19, sursum evanescentes, tertiarii transversi. Petiolus 0.4—0.6 cm longus, ferrugineo-lanato-tomentosus. Pedicellus 1.5—2 cm longus, pallide ferru-

gineo-subsericeo-tomentosus. Sepala 6, extus ferrugineo-subsericeo-tomentosa, intus glabra. Corolla glabra. Stamina 12, glabra. Ovarium 6-loculare, pallide cinnamomeo-tomentosum; stylus glaber. Fructus ignotus. Typus: *Haviland 898/901* in L.

Small trees. Branchlets slender, 2—2.5 mm in diam., ferruginously sericeous, glabrescent; terminal cone up to 3 mm long, ferruginously puberulous; stipules lanceolate, c. 2 by 0.5 mm, apex acute, pubescent on either side, caducous. *Leaves* subconferted at apex of branchlets, narrowly elliptic, 13—17 by 4—6 cm, apex long acutely acuminate, acumen up to 2 cm long, base rounded to broadly cuneate, almost not decurrent along adaxial side of petiole; juvenile ones cinnamomous sericeous-tomentose on either side, mature ones glabrous above, thin-coriaceous; midrib grooved above, prominent and rounded below, secondary nerves 17—19 pairs, ascending at an angle of c. 50°, slightly curved or straight and curved at their tips only, diminishing until inconspicuous near margin of leaf, inconspicuous and minutely grooved above, prominent below, tertiary nerves transverse, hardly visible on either side. Petioles 4—6 mm long, grooved above, rounded below, ferruginously woolly-tomentose. *Flowers* in 3—10-flowered, axillary clusters, sometimes in 2 fascicles, pedicels angular, 15—20 mm long, pale ferruginously appressedly tomentose. *Sepals* lanceolate, c. 4 by 1.8 mm, apex acute, ferruginously appressedly tomentose on outside, glabrous on inside, inner sepals with membranous and glabrous margins. *Corolla* 8—9 mm long, glabrous on either side, lobes ovate-elliptic, c. 6.5 by 2 mm, apex acute. *Stamens* 12, glabrous, filaments subulate, c. 1 mm long, anthers ovoid-oblong, c. 3 mm long, rounded and aristulate at apex, dehiscing lateral-extrorse. *Ovary* ovoid to globose, c. 1 mm in diam., 6-celled, pale cinnamomous tomentose. Style filiform, 9—10 mm long, glabrous. *Fruits* unknown.

Type specimen: *Haviland 898/801* in L.

Distribution: Borneo.

BORNEO. Sarawak, Rejang, Sibuan: *Haviland 898/801* (L), fl.

Remarks. This species is related to *P. calophyllum*, *P. quercifolium* and *P. sericeum*. It differs from *P. calophyllum* by the narrower and longer flowers, while the leaf-base is round against sharply cuneate. From *P. quercifolium* it differs in its smaller leaves and the round leaf-base. From *P. sericeum* it differs by its golden-brown pubescence of the lower side of the leaves as in *P. sericeum* this pubescence is greyish or ferruginous.

12. *P. philippense* (Perrottet) Robinson, Phil. J. Sc. 3, 1908, 304; Merrill, Sp. Blancoanae, 1918, 300; Brown, Minor Pr. Phil. For. 2, 1921, 168, f. 79; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 282; Lam, l. c. 1925, 59, 255; Lam, l. c. 1927, 400 — *Chrysophyllum philippense* Perrottet, Mém. Soc. Linn. Paris 3, 1824, 109 — *C. macrophyllum* Desfontaines, Cat. Hort. Par., ed. 3, 1829, 132, 398 — *Palaquium latifolium* Blanco, Fl. Fil., ed. 1, 1837, 404; idem, ed. 2, 1845, 282; idem, ed. 3, 2, 1878, 159; Vidal, Sinopsis Atlas 1883, 31, t. 62, f. B; Vidal, Rev. Pl. Vasc. Filip., 1886, 176; Merrill, For. Bur. Bull. 1, 1903, 46; Merrill, Bur. Gvt. Lab. Publ. 6, 1904, 14; idem, 27, 1905, 57; idem, Phil. J. Sc. 1, 1906, Suppl., 114 — *P. oleiferum* Blanco, l. c., ed. 1, 1837, 405; idem, ed. 2, 1845, 283; idem, ed. 3, 2, 1878, 160; Merrill, l. c. 1904, 14; Merrill, Bur. Gvt. Lab. Publ. 27, 1905, 57; idem, Phil. J. Sc. 1, 1906, Suppl., 114; Dubard, Bull. Mus. Hist. nat. 15,

1909, 383 — *Chrysophyllum grandifolium* Steudel, Nomencl., ed. 2, 1, 1840, 359; DC, Prodr. 8, 1844, 163; Miquel, Fl. Ind. Bat. 2, 1859, 1035; F.-Vill., Nov. App., 1880, 124 — ? *Bassia blancoi* DC, l. c. 1884, 199 — ? *B. oleifera* DC, l. c. 1844, 199 — *Dichopsis latifolia* F.-Vill., Nov. App., 1880, 124 — *D. oleifera* F.-Vill., l. c. 1880, 125 — *Palaquium aureum* Elmer, msc. — Fig. 3.

Trees, up to 25 m. Branchlets irregularly terete by the numerous scars, 5–12 mm in diam., greyish, yellowish, brown or ferruginously tomentose or sericeous as are lower side of leaves, pedicels, petioles and outside of calyx, branchlets ultimately glabrous; terminal cone 7–15 mm long, tomentose; stipules lanceolate, 6–8 by 1.5–3 mm, apex acute, tomentose on outside, glabrous on inside and along outside of margin, often crested on outside, caducous. *Leaves* subconferted at apex of branchlets, obovate, obovate-oblong, spatulate, or subelliptic, 17–37 by 6–10 cm, apex obtuse and usually acutely, sometimes obtusely acuminate, acumen up to 10 mm long, or sometimes acute, base rounded, sometimes broadly cuneate, very shortly decurrent but apparently very longly decurrent along adaxial side of the petioles with 2 walls; glabrous above but sometimes pubescent in basal part of midrib, sericeous below, thinly coriaceous; midrib grooved and minutely crested above, prominent and angular below, secondary nerves 10–16 pairs, ascending at an angle of c. 50°, straight, curved or slightly S-shaped, curved at their tips, diminishing until inconspicuous near margin, prominulous above and often grooved, prominent below, tertiary nerves transverse, slender, inconspicuous on either side, below very indistinct by the dense pubescence. Petioles stout, 7–22 mm long, flat and with 2 crests above, angular below, tomentose. *Flowers* in 4–7-flowered, axillary clusters, pedicels angular, 13–45 mm long, in fruit stouter only. *Sepals* elliptic-ovate or broadly ovate, 3.5–4.5 by 4–5 mm, apex obtuse, the inner sepals with rounded apex, ferruginously sericeous-tomentose on outside, glabrous on inside, inner sepals with membranous and fimbriate margins and tomentose on outside in a small triangular-lanceolate central area only. *Corolla* 9–16 mm long, sparsely ferruginously sericeous on the tube in epipetalous lines, lobes elliptic-oblong, 7–11 by 3–5 mm, apex obtuse, rounded or truncate. *Stamens* 12–18, entirely glabrous, filaments filiform, angular, 3.5–4.5 mm long, anthers elliptic-oblong, 3.5–4 mm long, apex rounded and mucronate, dehiscing extrorsely lateral. *Ovary* ovoid, c. 1.5 by 2 mm, 6-celled, 12-lobed at base, glabrous. Style filiform, 10–22 mm long, glabrous. *Fruits* ellipsoid or subovoid, up to 3 by 2 cm, with the marcescent style at the rounded apex, one-seeded (always?), glabrous. Seeds unknown.

Type specimen: *Perrottet s.n.* in P.

Vernacular names: agrado (Bagóbo language); nato-pulá (Bikol language); araka (Ibanág language); dalákan, darákan (Ilóko language); apaka-paka bitok (Negrito language); alakáak, alákau, malasaputi, pakankal, palak-pálak (Pampángan language); manogtalí-sai (Panay Bisáya language); pakaran (Pangasinán language); tagogong (Sambáli language); agas, alakáak-na-pulá, alákap, dolítan, dolítan-taklóban, manimparog, palak-pálak (Tagalog language).

Ecology: Common in primary forests at low and medium altitudes.

Distribution: Philippines (Luzon, Leyte, Mindoro, Panay, Negros, Mindanao).

LUZON. Sorsogon prov., Mt. Bulusan: *Elmer 15775* (BO, FI, G, L, NY, S), fr. April, 'type' of *P. aureum* Elmer, msc; ibidem: *Vidal 1560* (FI, L), April; Albay: *Curran 10613* (L), June; Manila prov., Malacañang Palace: *Sulit 5251* (L, PNH), tree 12 m, fl. March; Manila: *Perrottet s.n.* (P), fl.; Tayabas prov., Pagbalao: *Merrill 1919* (SING), fl. April; Rizal prov.: *Ahern's Collector 3250* (BO, SING), fl. Aug.; ibidem: *Ahern's Collector 3350* (GEN), fl. Sept.; Bosoboso: *Ahern's Collector 1853* (BO, SING), fl. Sept.; Antipolo: *Merrill Species Blancoana 662* (BO, L), June; ibidem: *Merrill Species Blancoana 934* (BO, L), June; San Mateo: *Ahern's Collector 1103* (BM), fr. May; ibidem: *Vidal 1564* (MA), fl. buds; Bataan prov., Lamao river: *Barnes 131* (SING), fl. Jan.; Bulacan prov., Angat: *Aguilar 11186* (SING), March/April; Batangas prov., Mt Makiling: *Baker 2216* (SING), fl. Dec.; ibidem: *Baker 2872* (SING), fl. Febr.; Camarines Sur prov., Mt Ysarog: *Edaño 76237* (SING), fl. Dec.; Mt Bagacay: *Ramos & Edaño 33914* (K), fl. Nov.-Dec.; Tarlac prov., Concepcion: *Merrill 3617* (L), fl. Nov.; without loc.: *Reillo 19261* (L), fl. Dec.; ibidem: *Loher 6564* (BO).

LEYTE. Ormoc, Lake Danao: *Edaño 11909* (L, PNH), tree 12 m, fl. March.

MINDORO. Mt Calavite: *Ramos 39449* (K), fr. April.

PANAY. Capiz prov.: *Edaño 45990* (BO, SING), fl. Oct./Nov.

MINDANAO, NEGROS, f. Merrill 1923, 282 and Lam 1925, 59.

Remark. *Elmer 11816* (f. Lam 1925, 59) is excluded as it represents *P. montanum* Elmer.

13. *P. sorsogonense* Elmer ex Lam, l. c. 1925, 65, f. 13; Lam l. c. 1927, 401.

Trees, c. 10 m. Branchlets slender, 3–6 mm in diam., brownish woolly hirsute, glabrescent; terminal cone up to 7 mm long, woolly hirsute; stipules broadly ovate, c. 7 by 6 mm, apex obtuse, crested, ferruginously woolly hirsute on outside but glabrous and cartilaginous along the margins, glabrous on inside. Leaves conferted at apex of branchlets, obovate or pandurate, 16–25(–31) by 7–12(–16) cm, apex rounded and acutely acuminate, acumen up to 6 mm long, base broadly to narrowly cuneate or rounded to subtruncate; glabrous above except in the basal part of the midrib, sparsely brownish woolly hirsute below, denser so on nerves and midrib, chartaceous to thin-coriaceous; midrib grooved above, sometimes minutely crested as well, prominent and rounded below, secondary nerves 15–18 pairs, ascending at an angle of c. 60°, straight, curved at their tips, diminishing until inconspicuous near margin of leaf, prominulous and slightly grooved above, prominent below, tertiary nerves slender, transverse, prominulous on either side. Petioles stout, 9–15 mm long, brownish or ferruginously woolly, grooved above, angular or ribbed below. Flowers in 3–5-flowered clusters, pedicels angular, (3–)7–25 mm, brownish or ferruginously woolly. Outer sepals triangular-ovate, 5–6.5 by 4–5.5 mm, apex acute, crested, ferruginously or greyish brown hirsute on outside, glabrous on inside, inner sepals elliptic-obovate, 5–7 by 4.5–6 mm, apex rounded, crested, glabrous on outside and on inside except for a crested, narrow, linear patch in the basal part, margins membranous. Corolla 7–12 mm long, glabrous, lobes lanceolate-ovate, 9–12 by 1.5–3 mm, apex obtuse or truncate. Stamens 18,

Fig. 3. *P. philippense*, a. branchlet with leaves and flowerbuds; b. tertiary nervation of leaf (*Edaño 45990*).



5—7.5 mm long, filaments subulate, 1.5—2.5 mm long, glabrous, anthers oblong-sagittate, 4—5 mm long, apex acute, glabrous, dehiscing introrsely. *Ovary* depressedly globose, c. 1.5 by 2.5 mm, 6-celled, glabrous. Style filiform, up to 11 mm long, glabrous. *Fruits* broadly ellipsoid, up to 1.8 by 1.5 cm, 1-seeded, apex rounded, with a short remnant of the style which is starshaped broadened at its base, pericarp woody, glabrous. Seeds similar to fruit but smaller, testa cartilaginous, dark brown, dull, embryo exalbuminous.

Lectotype specimen: Elmer 16714 in PNH.

Ecology: In swamps at lower altitudes.

Distribution: Luzon, Biliran, Samar, Leyte.

LUZON. Sorsogon prov., Mt Bulusan: *Elmer 16714* (FI, G, L, NY, S), fl. July; Cagayan prov., Luchan, Abulug, swampy places: *Veracion PNH 33433* (L, PNH), tree 7 m, fl. Jan.; Tayabas prov., Malbog: *Oro 30700* (NY, SING), fl. Jan.; Camarines prov., Mt Bagacay: *Ramos & Edaño 33907* (L), fl. Nov./Dec. BILIRAN. Mt Suiro: *Sulit PNH 21572* (L, PNH), fl. buds, imm. fr., April/May. SAMAR. Catubig river: *Ramos 24379* (K, NY), fl. Febr.; Mt Cansayao, Catarman: *Sulit 14409* (L, PNH), tree 10 m, fl. & fr. April.

LEYTE. Mt Abucayan: *Edaño 41724* (K, L), fl. Febr.

Remark. The fruits have been described from *Sulit 14409* in L.

14. *P. majas* H. J. Lam, l. c. 1925, 66, f. 14; Lam, l. c. 1927, 401.

Trees? Branchlets slender, 3—5 mm in diam., ferruginously woolly-hirsute, ultimately glabrous; terminal cone up to 7 mm long, woolly hirsute; stipules broadly ovate, up to c. 4 by 3.5 mm, apex acute, woolly hirsute on outside, glabrous on inside, caducous. *Leaves* scattered, broadly obovate, 16—25 by 10—15 cm, apex rounded and acutely acuminate, acumen up to 7 mm long, base broadly truncate or rounded, not or almost not decurrent; glabrous above, sometimes ferruginously hirsute at base of midrib, ferruginously woolly-hirsute below mainly on midrib and nerves, chartaceous; midrib grooved above, prominent and rounded below, secondary nerves 12—17 pairs, ascending at an angle of c. 60°, straight, curved at their tips, archingly joined very close to the margin, grooved above, prominent below, tertiary nerves slender, transverse, distinct on either side. Petioles stout, 10—15 mm long, grooved above, ferruginously woolly hirsute. *Flowers* in 5—9-flowered, axillary clusters, pedicels angular, 15—22 mm long, ferruginously woolly-hirsute. *Sepals* lanceolate, 4.5—6 by 2.5—3.5 mm, apex acute, ferruginously woolly-hirsute on outside, glabrous on inside, inner sepals with membranous margins and sometimes crested. *Corolla* entirely glabrous, 7—9 mm long, lobes elliptic-oblong, 6—7 by 2—2.5 mm, apex acute or subacute. *Stamens* 18, entirely glabrous, 5—6 mm long, filaments filiform, 1.5—2 mm long, anthers oblong, 3—3.5 mm long, apex bifid, dehiscing laterally. *Ovary* broadly ovoid, c. 1 by 1.5 mm, 6-celled, 6-lobed, ferruginously hirsute. Style 10—11 mm long, glabrous, subpubescent at base. *Fruits* globose or ellipsoid, 1—2 by 1—1.5 cm, 1-seeded, pericarp fleshy, glabrous. Seeds ellipsoid, 9—18 by 6—13 by 5—11 mm, subobtuse at either end, testa thin, scar covering half the surface of seed; embryo exalbuminous, radicle subexsert.

Type specimen: Jaheri 1085 in BO.

Distribution: Borneo.

BORNEO. Indonesian Borneo, Sungeibrunei: *Jaheri 1085* (BO, L), fl.; Sungei Bulu: *Jaheri 1054* (BO, L), fl.; ibidem: *Jaheri 1458* (BO, L).

15. *P. fidjiense* Pierre in Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 10; Lam, l. c. 1925, 107; Lam, l. c. 1927, 414; Lam, Blumea 5, 1, 1942, 33.

Trees, up to 30 m. Branchlets slender, 1.5–3.5 mm in diam., ferruginously or cinnamomously puberulous, glabrescent; terminal cone 2–7.5 mm long, puberulous; stipules lanceolate-acicular, c. 3 by 0.5 mm, acute at apex, puberulous on outside, glabrous on inside, caducous. *Leaves* conferted at apex of branchlets, obovate-spathulate, oblong or obovate, 6–12 by 2.5–4 cm, apex obtuse or obtusely acuminate, acumen up to 3 mm long, base cuneate, decurrent along sides of petiole; either entirely glabrous or ferruginously puberulous on either side of the midrib, thin-coriaceous; midrib grooved and minutely crested above, prominent and rounded below, secondary nerves slender, 9–15 pairs, ascending at an angle of c. 70°, slightly curved, diminishing until inconspicuous, rarely joined by some thickened tertiary nerves, prominulous above, stronger so below, tertiary nerves few, transverse, not distinctly marked against the intermediate reticulate nervation, prominulous on either side. Petioles 3–9 mm long, grooved or flat above and sometimes slightly crested as well, thickened in the basal part, ferruginously tomentose, partly glabrescent. *Flowers* in 2–4-flowered, axillary clusters or solitary, pedicels terete, 2–8 mm long, ferruginously tomentose. *Sepals* ovate, 1.5–2.5 by 1.5–2.5 mm, in fruit up to c. 3 by 3 mm, acuminate at apex, ferruginously tomentose on outside, glabrous on inside, inner sepals with membranous margins. *Corolla* 2–4 mm long, pubescent at apex only, lobes ovate-rotundate, c. 1.5 by 1.5 mm, obtuse at apex. *Stamens* 12, c. 1.5 mm long, filaments subulate, c. 0.6 mm, glabrous, anthers oblong, c. 1 mm long, apex obtuse (?), ferruginously villose. *Ovary* ovoid, c. 1 by 1 mm, 6-celled, 6-lobed, ferruginously villose. Style subulate, c. 3 mm long, glabrous. *Fruits* ovoid, c. 1.8 by 1.3 by 1 cm, 2-seeded, apex obtuse, pericarp fleshy, glabrous. Seeds fusiform, c. 13 by 5 by 4 mm, obtuse at either end, yellowish, shiny, scar linear. Embryo unknown.

Type specimen: *Horne 1117* in K.

Vernacular name: souwalu (Viti Levu).

Ecology: In dense forests at low and medium altitudes.

Distribution: Fiji (Viti Levu, Vanua Levu, Ovalou).

VITI LEVU. Tholo North, Nandarivatu, alt. 830 m: *Greenwood 842* (K, NY), tree 5 m, fl. & fr. May; ibidem, eastern slopes of Mt Koroyaniyu, Mt Evans Range, alt. 950–1050 m, dense low forest: *A. C. Smith 4165* (K), tree 15 m, fl. May; ibidem, slopes of Mt Nairoso, Mt Evans Range, dense forest, 700–1050 m alt.: *A. C. Smith 4421* (K), tree 8 m, fl. April; hills between Nandala river and Nukunuku Creek, 750–850 m alt., dense forest: *A. C. Smith 6195* (K), tree 30 m, fr. green, Sept.; ridge between Mt Lomalangi and Mt Namama, east of Nandarivatu, alt. 1050–1120 m, dense forest: *A. C. Smith 4995* (K), tree 8 m, fl. June.

VANUA LEVU. Thakaundrove, Yanaway region, Mt Kasi, alt. 300–430 m, dense forest: *A. C. Smith 1805* (A, BISH, K, L, US), tree 15 m, fl. May, buds brown; without loc., shaded woods: *Horne 1117* (K), tree 5–8 m, fl. Sept.

OVALAU. Hills west of Lovoni Valley, on ridge S. of Korolevu, alt. 400–500 m, dense forest: *A. C. Smith 7543* (L, US), tree 15 m, fl. May; Mt Ndelaiovalau, alt. 575–626 m, dense bush and thickets of crest: *A. C. Smith 7616* (L, US), tree 8 m, fl. May; Mt Tana Lailai, alt. 500–550 m, dense bush and thickets of crest: *A. C. Smith 7689* (L, US), tree 8 m, fl. June.

16. *P. formosanum* Hayata, J. Coll. Sc. Tokyo 30, 1911/1912, 184; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; idem, vol. 4, 1926, 245; Kanehira, Formos. Tr., rev. ed., 1936, 570, f. 520; Liu, Sasaki & Keng, Quart. J. Taiwan Mus. 8, 4, 1955, 313 — *P. polyandrum* Hayata, l. c. 185 — *P. ellipticum* Hayata in Matsumura & Hayata, Enum. Pl. Formos., 1906, 227 — *P. paucivenosum* H. J. Lam, l. c. 1925, 101, f. 29; Lam, l. c. 1927, 412 — *P. hayatae* H. J. Lam, l. c. 1927, 414.

Trees, 5—7 m. Branchlets terete, stout, 5—8 mm in diam., pale cinnamomously tomentose, glabrescent; terminal cone up to 8 mm long, tomentose; stipules lanceolate, up to 3 by 1.5 mm large, apex acute, greyish tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, subconferted or conferted at apex of branchlets, obovate-oblong, obovate or spatulate, 10—17 by 4.5—7.5 cm, apex rounded or cordate, base broadly cuneate, rounded or cordate, not or almost not decurrent; glabrous on either side, or with scattered white hairs or puberulous on midrib only or on the secondary nerves as well, the juvenile leaves sometimes pale cinnamomously puberulous on either side, coriaceous; midrib prominulous above and indistinctly crested, prominent and rounded below, secondary nerves 10—12 pairs, ascending at an angle of c. 50°, slightly curved or straight and curved at tips only and irregularly archingly joined, prominulous above, prominent below, the basal ones inconspicuous on either side, tertiary nerves few, far apart, transverse, with a few nerves in between which are as conspicuous as the tertiary nerves, conspicuous on either side. Petioles stout, 7—12 by 2—3 mm, flat above and with 2—4 longitudinal crests, pale yellowish puberulous. *Flowers* in 3—6-flowered, axillary clusters, pedicels angular, 7—12 mm long, in fruit up to 28 mm long and thickened, ferruginously yellowish tomentose. Flowers seen in bud only. *Sepals* broadly ovate, 4—4.5 by 4—5 mm, apex subacute or obtuse, yellowish puberulous on outside, glabrous on inside, in fruit enlarged up to 6 by 5 mm, inner sepals with glabrous and membranous, sparsely ciliate margins. *Corolla* known young only, glabrous on either side, c. 2.5 mm long, lobes oblong, c. 1.5 by 1.5 mm, apex obtuse. *Stamens* 12, the epipetalous longer than the alternipetalous ones, filaments very short, probably glabrous, anthers ovoid, c. 1.5 mm long, apex subacute, dehiscing extrorsely lateral, sparsely ferruginously sericeous. *Ovary* disciform, c. 1 by 1.5 mm, 6-celled, glabrous. Style subulate, stout, c. 1 mm long, glabrous. *Fruits* narrowly ellipsoid, often oblique, 4—5 by 1.5—2 cm, 1-seeded, apex rounded or subtruncate, often with the up to 15 mm long marcescent style still present, narrowed at base, pericarp fleshy, glabrous. Seeds fusiform, but compressed at either side, up to 3.5 by 1.1 by 0.9 cm, obtuse at apex, acute at base, probably brown and nitidous, scar covering half of the seed, dull, grey, embryo exalbuminous, radicle exsert.

Type specimen: *Makino s.n.* in TI.

Vernacular name: nátu (Ivatán dialect).

Ecology: In thickets and forests at low altitude.

Distribution: Formosa, Botel-Tobago (Lan Yu Islands), Batan Islands, Babuyan Islands, Luzon.

FORMOSA. Without known loc.: *Henry 341* (NY), fr.

BABUYAN. Camaguin, Babuyanes, steep forest-slope: *Fenix 4101* (SING), tree 5—7 m, type specimen of *P. paucivenosum* H. J. Lam.



J.T. '57.

Fig. 4. *P. kinabaluense*, a, branchlet with leaves and fruit; b, tertiary nervation of leaf (Clemens & Clemens 27635).

LAN YU. Sharyoto: *Makino s.n.* (TI), Nov.

BATAN. Mt Iraya: *Ramos 80219* (B), fl. & fr. June/July.

LUZON. Without known loc.: *Haenke 434* (NY), fl. buds.

17. *P. erythrospermum* H. J. Lam, *Blumea* 5, 1, 1942, 31—32, f. 6.

Trees, up to 25 m. Branchlets terete, c. 5 mm in diam., scattered whitish puberulous, glabrescent and striate when dry; terminal cone c. 6 mm long, sparsely whitish hairy, stipules lanceolate, up to 5 by 2 mm, apex obtuse, sparsely whitish hairy on outside, glabrous on inside, caducous. *Leaves* scattered, obovate-oblong, 19—26 by 10—15 cm, apex rounded to short obtusely acuminate, base broadly cuneate, shortly decurrent along adaxial side of petiole; glabrous on either side, chartaceous; midrib crested above, prominent and rounded below, secondary nerves 12—15 pairs, ascending at an angle of 60°—70°, straight but curved at their tips, diminishing until inconspicuous, prominulous above, prominent below, tertiary nerves transverse, slender. Petioles 2—3 cm long, flat above, glabrous. *Flowers* in few-flowered, axillary clusters, pedicels angular, 9—12 mm long, ferruginously tomentose. *Sepals* ovate to rotundate-ovate, 2.5—3.5 by 2—2.5 mm, apex obtusely acuminate, ferruginously tomentose on outside, glabrous on inside. *Corolla* unknown. Stamens not seen but according to Lam probably 14, anthers pilose on outside. *Ovary* broadly ovoid, subabruptly tapering into style, c. 1 by 2 mm, 6-celled, ferruginously tomentose. Style filiform, angular, c. 10 mm long, glabrous. *Fruits* oblong, 2.5—3.8 by 1—1.8 cm, apex obtuse, 1-seeded, glabrous, pericarp woody, black, seeds oblong, black, exalbuminous, cotyledons thick, radicle c. 5 mm long, obtuse.

Type specimen: *Kajewski 1903* in L.

Vernacular name: ocko-woru (Bougainville).

Ecology: In lowland rainforests.

Distribution: Solomons.

BOUGAINVILLE. Kugumaru, Buin, alt. 150 m, rainforest: *Kajewski 1903* (A, G, L), fr. July, large tree, up to 25 m.

18. *P. rivulare* H. J. Lam, l. c. 1927, 403, f. 4.

Trees, c. 10 m. Branchlets terete, 3.5—6.5 mm in diam., light brown tomentose-hirsute, soon glabrous; terminal cone up to 14 mm long, sparsely tomentose-hirsute; stipules oblong or oblong-ovate, oblique, 9—15 by 4—6 mm, obtuse or subacute at apex, slightly crested at the back, subchartaceous, sparsely light brown tomentose-hirsute on outside, especially in the middle, glabrous on inside, caducous. *Leaves* scattered, oblong, 24—48 by 8—14.5 cm, obtuse and long obtusely acuminate, acumen up to 2.5 by 0.4 cm, base rounded, unequal, very shortly decurrent along upper side of petiole; glabrous or on underside sparsely brownish puberulous along midrib, membranous-chartaceous; midrib grooved above and minutely crested as well, prominent and rounded below, secondary nerves 18—22 pairs, ascending at an angle of 45°—60°, at base up to 80°, curved, diminishing until inconspicuous near margin, prominulous above and grooved as well, prominent below, tertiary nerves slender, transverse, prominulous but distinct on either side. Petioles stout, 9—26 mm, flat above, rounded below, sparsely ferruginously tomentose but soon glabrous, underside rugulose. *Flowers* in (3—)5—8-flowered, axillary clusters, pedicels angular, 3—8(—10) mm

long, ferruginously puberulous, rugose (according to Lam becoming glabrous). *Sepals* ovate-triangular, 2.5—4 by 3—5 mm, subacute or obtuse at apex, ferruginously tomentose on outside, glabrous on inside, inner sepals more rotundate, membranous and glabrous along margins, fimbriate along edges. *Corolla* seen in bud only, 4—4.5 mm long, on outside ferruginously sericeous on tube and along the middle-line of the lobes, fimbriate along tips of lobes; lobes ovate-oblong, 3.5—4 by 2—2.5 mm, obtuse. *Stamens* 18—21, in 2 or 3 whorls, 3.5 mm long, filaments very short, subulate, 0.5—1.5 mm long, ferruginously hirsute, anthers narrowly ovoid, 3—4.5 mm long, acuminate at apex, ferruginously sericeous, dehiscent extrorsely. *Ovary* very low conoid, c. 0.5 by 2 mm, 6-celled, 6-angular, ferruginously hirsute, at base surrounded by a 12-lobed disk. Style cylindric, stout, 3—4 mm long, glabrous, after anthesis up to 16 mm long. *Fruits* unknown.

Type specimen: *Endert 3021* in BO.

Ecology: In forests at low altitudes.

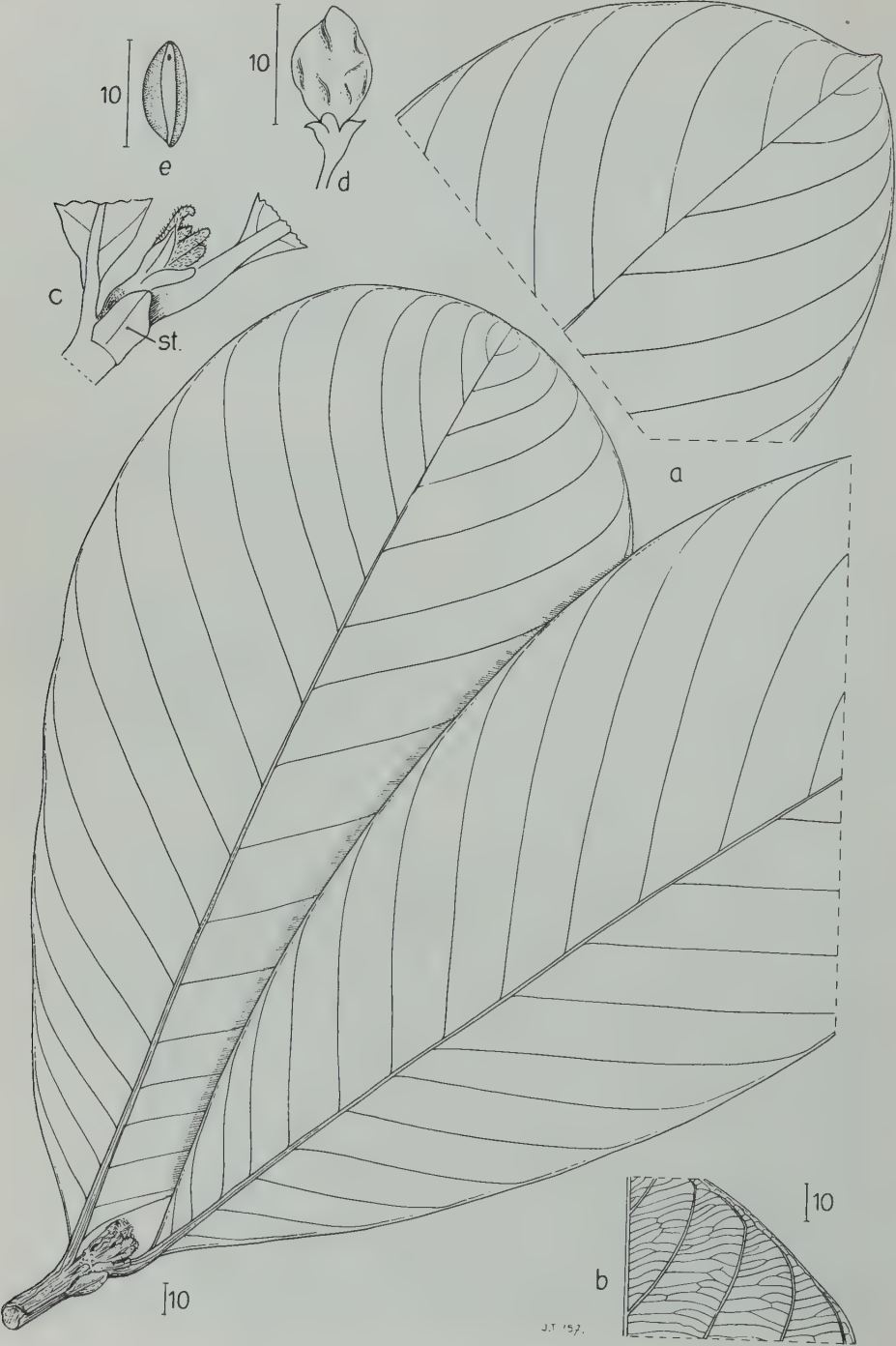
Distribution: Borneo.

BORNEO. W. Kutai, near L. Liang Leng, on a rock along rivulet in small ravine, in old forest, alt. c. 250 m: *Endert 3021* (BO, L), tree c. 10 m, fl. buds, Aug.; Kelindjau river region near Bentuk: *Kostermans 9701* (BO, L), tree 20 m, fl. white, June.

19. *P. kinabaluense* van Royen, n. sp. — *P. cf. macrocarpum* Burret, Heyne in msc. — Fig. 5.

Arbor magna. Ramuli crassi, pallide ferrugineo-lanato-tomentosi, glabrescentes; stipulae oblongo-ovatae, obtusae, cristatae, caducae. Folia obovata vel subpanduriformia, 18—25(—41) × 8.5—11.5(—18) cm, apice rotundata vel brevissime obtuse acuminata, supra sparse albo-tomentosa, denique glabrescentia, subtus sparse flavido-tomentosa, glabrescentia. Nervi secundarii utroque latere 9—12(—18), sursum evanescentes, tertiarii transversi. Petiolus (1—)2—4 cm longus, ferrugineo-sericeus, (sub)glabrescens. Pedicellus usque ad 4 mm longus, ferrugineo-tomentosus. Sepala extus lanato-tomentosa, intus glabra. Corolla glabra, sed apice loborum fimbriata. Stamina 12, glabra. Ovarium 6-loculare, in parte apicali ferrugineo-hirsutum; stylus glaber. Fructus incompletus. Typus: *Clemens & Clemens 27635* in L.

Large trees. Branchlets stout, 5—7 mm in diam., pale ferruginously woolly-tomentose, glabrescent, terminal cone up to 8 mm long, pale ferruginously woolly-tomentose; stipules oblong-ovate, up to 7 by 3.5 mm, usually obtuse at apex, crested, pale ferruginously tomentose on outside except along margins, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, obovate or subpanduriform, 18—25(—41) by 8.5—11.5(—18) cm, rounded or very short obtusely acuminate at apex, broadly cuneate at base and subabruptly narrowed, slightly decurrent along upper sides of petioles; sparsely whitish tomentose above and glabrescent, sparsely yellowish tomentose below, denser so on midrib and nerves, ultimately glabrous, coriaceous; midrib broad and shallowly grooved above, prominent below and rounded in the basal part but flattened in the apical part, secondary nerves 9—12(—18) pairs, ascending at an angle of c. 60°, straight but curved at their tips, diminishing until inconspicuous near margin, prominent above and grooved, very prominent below, tertiary nerves slender, transverse, prominulous on either side. Petioles (1—)2—4 cm long, broad and shallowly grooved above, rounded below, ferruginously sericeous, glabrescent or only partly so. *Flowers* solitary or 2—8 in the apical axils, pedicels terete, up to 4 mm long, in fruit up to 10 mm long, ferruginously woolly-tomentose,



partly glabrous in fruit. *Sepals* triangular or triangular-ovate, 2.5—3 by 2—2.5 mm, obtuse, woolly-tomentose on outside, glabrous on inside, inner sepals more ovate than outer ones, crested, with glabrous and membranous margins. *Corolla* up to 7 mm long, entirely glabrous, except fimbriate at apex of lobes, lobes ovate-lanceolate, 3—5 by 1.5—2 mm, obtuse at apex. *Stamens* 12, c. 3 mm long, entirely glabrous, filaments subulate, c. 1 mm long, anthers lanceolate-oblong, c. 2.5 mm long, connective elongate, acute, dehiscing extrorsely. *Ovary* obovoid-disciform, c. 0.7 by 1.5 mm, 6-celled, pale ferruginously hirsute in the apical half only, style stout, conoid, c. 4.5 mm long, glabrous. *Fruits* known young only, ovoid, up to 9 by 5 mm, one-seeded, glabrous. Seeds unknown.

Type specimen: *Clemens & Clemens 27635* in L.

Ecology: In primary forests at medium altitudes.

Distribution: Borneo.

BORNEO. Sarawak, Mt Kinabalu, Dallas, alt. 1000 m: *Clemens & Clemens 27635* (BM, CAL, G, K, L, SING), tree, fl. Dec., immature fr. green; Gat, Upper Rejang river: *Clemens & Clemens 21532 & 21824* (BO), tree, fl. cream.

Remarks. This species is so closely related to *P. sorsogonense*, that only after some hesitation it was regarded as a separate species and not a mere variety of the first mentioned species. Its main differences are the smaller number of secondary nerves (9—12 pairs against 15—18), the number of stamens (12 against 18), the longer petioles (2—4 cm against 0.9—1.5 cm) and the shorter pedicels (up to 4 mm against (3—)7—25 mm). Moreover the dimensions of leaves and flowers are smaller than those of *P. sorsogonense*. In many respects it resembles *P. macrocarpa* Burek but is distinguished from the latter by the larger stipules and leaves, but with the same number of secondary nerves, however. Also the glabrous anthers and the small number of flowers in each axil distinguish *P. kinabaluense* from *P. macrocarpum*.

20. *P. gigantifolium* Merrill, Bur. Gvt. Lab. Publ. 6, 1903, 14; Dubard, Bull. Mus. Hist. Nat. 15, 1909, 384; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l. c. 1925, 75; Lam, l. c. 1927, 407.

Medium sized tree, c. 18 m tall. Branchlets stout, terete, 9—18 mm in diam., pale yellowish puberulous, glabrescent; terminal cone up to 22 mm long, puberulous; stipules oblong, up to 6 by 1.2 cm, obtuse or aristate, crested dorsally, puberulous on outside, glabrous on inside, long persistent, finally caducous. *Leaves* crowded towards the ends of branchlets, obovate, obovate-elliptic, or oblanceolate, (20—)45—68 by (9—)12.5—22 cm, apex obtuse, acute or acuminate and acumen up to 7 mm long, base broadly subrotundate, shortly decurrent along adaxial side of petioles; glabrous on either side, chartaceous; midrib broadly grooved above and sometimes broadly crested as well but usually in the apical part only, prominent and rounded below, secondary nerves 20—32 pairs, ascending at an angle of c. 50°, straight but curved at their tips and diminishing until inconspicuous, rarely connected by thickened tertiary nerves or archingly joined, promi-

Fig. 5. *P. cuprifolium*, a. leaves; b. tertiary nervation of leaf; c. apex of branchlet, with stipule (st); d. fruit; e. seed (*Elmer 13263*).

nulous and grooved above, prominent below, tertiary nerves slender, transverse, prominulous on either side. *Petioles* stout, 3.5—5 by 0.4—0.7 cm, thickened in the basal part, glabrous. *Flowers* in 4—8-flowered, axillary clusters, pedicels angular, 8—14 mm long, in fruit up to 18 mm long, ferruginously puberulous. *Sepals* ovate, 5.5—10 by 4—8 mm, obtuse or subacute at apex, often dorsally crested, ferruginously tomentose on outside, glabrous on inside, inner sepals more rotundate, with membranous, glabrous margins which are fimbriate. *Corolla* 1.6—2.5 cm long, glabrous, lobes ovate-lanceolate, 1.4—2 by 0.3—0.6 cm, obtuse. *Stamens* 18—24, 10—19 mm long, filaments filiform, 6—16 mm long, glabrous, anthers oblong, 3.5—4.5 mm long, acuminate, with scattered ferruginous hairs, dehiscing laterally, often twisted. *Ovary* ovoid, 1.5—3.5 by 1—2.5 mm, 6-celled, glabrous. *Style* filiform, 1.5—2.5 cm long, glabrous. *Fruits* obliquely ellipsoid or obpyriform, 2.2—4.5 by 0.9—3 by 0.8—2.5 cm, 1-seeded, obtuse, often provided with a short remnant of the style, pericarp thin, woody, glabrous. *Seeds* similar in shape to the fruit, 2—2.8 by 0.7—1.6 by 0.5—1.4 cm, brownish yellow, scar covering $\frac{1}{3}$ of the surface of the seed, testa crustaceous, embryo exalbuminous.

Type specimen: *Merrill 2845* in PNH.

Lectotype specimen: *Merrill 2845* in NY.

Vernacular names: tagkan (Mabido dialect), alakáa, alakéak, bayátis, dulitan, lakodog (Tagalog dialect).

Ecology: In primary forests at low altitudes.

Distribution: Philippines.

LUZON. Tayabas prov., Pagbilao: *Merrill 2845* (NY), fr.; ibidem: *Bawan 25356* (SING), juv. fr. April; Lucban: *Elmer 9129* (E, FL, G, NY), juv. fr. May.

MINDORO. Pinamalayan: *Ramos 40992* (BO, SING), fr. June; Alagoa river: *Merrill 5767* (NY), fl. Nov.; Baco river: *Merrill 4055* (NY), March.

CATANDUANES. Without known loc.: *Ramos & Edaña 75577* (NY, SING), tree 8 m, fl. July/Sept.

Remark. As the type specimen in the Manila herbarium became lost during the war a lectotype specimen has been chosen from among the original material distributed to other herbaria.

21. *P. globosum* H. J. Lam, l. c. 1925, 76; Lam, l. c. 1927, 407 — *P. retusum* Merrill, Phil. J. Sc. 3, 1908, 256; Dubard, Bull. Mus. hist. nat. 15, 1909, 384; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 283.

Trees, c. 10 m tall. Branchlets stout, 5—17 mm in diam., glabrous, angular by the numerous leaf scars, rugose; terminal cone large, up to 35 by 15 mm, ferruginously tomentose; stipules oblong-ovate or shieldlike, 1—3.5 by 0.8—2 cm, obtuse, acuminate or aristate at apex, dorsally crested, glabrous, long persistent, even after the leaves have fallen off. *Leaves* crowded towards tips of branchlets, oblanceolate or narrowly oblong-obovate, 19—49 by 6.5—14 cm, obtuse, rounded or retuse at apex, base narrowly cuneate, decurrent along sides of petioles; glabrous, coriaceous; midrib broadly impressed above and minutely crested as well, prominent and rounded below, secondary nerves 12—18 pairs, ascending at an angle of c. 45°, straight but curved at their tips, diminishing until inconspicuous near margin, prominulous above, stoutly prominent below, tertiary nerves transverse, slender, prominulous on either side. *Petioles* 1—5 cm, flat

above, angular or rounded below, slightly thickened in basal part and of different colour, glabrous. *Flowers* in 2- or 3-flowered, axillary clusters, pedicels angular, 1—1.5 cm long, in fruit up to 3 cm long, dark brown or ferruginously tomentose. *Sepals* triangular-ovate, 5—6 by 4.5—5.5 mm, subacuminate or subobtusate at apex, ferruginously tomentose on outside, glabrous on inside, fimbriate. *Corolla* 10—12 mm long, on outside sparsely pubescent on tube, lobes narrowly lanceolate, 8—10 by 2—3 mm, subacute at apex, glabrous on outside, puberulous in throat and on base of petals on inside. *Stamens* 20—24, 3—6 mm long, filaments filiform, 2—5 mm long, ferruginously puberulous, anthers lanceolate, 2.5—3 mm long, apex acute or bifid, dehiscing laterally, glabrous. *Ovary* ovoid, c. 1 by 1.5 mm, 9—24-celled, glabrous. *Style* filiform, 1.5—2 cm long, glabrous. *Fruits* globose, 3.5—4 by c. 3.5 cm, at apex with a short remnant of the style, 4—6-seeded, pericarp thick, fleshy, glabrous; seeds incompletely known.

Lectotype specimen: *Elmer 8523* in L.

Vernacular names: adagi, arábon (Igorot).

Ecology: In forests and forested ravines, alt. 300—1200 m.

Distribution: Philippines.

LUZON. Pangasinan prov., Labrador: *Fénix 29934* (BO), fr. Nov.; ibidem: *Fénix 29837* (L), fl. Nov.; without known loc.: *Leaño 25154* (NY), fl. March. — Benguet prov.: *Elmer 8523* (BO, E, FI, G, L, NY), fl. March; ibidem: *Curran 10917* (NY), fl. Dec.

Remark. As no type specimen has been indicated by Merrill nor Lam the specimen collected by Elmer under No. 8523 in the Leiden herbarium has been chosen as the specimen typifying this species.

22. *P. cuprifolium* Elmer, Leaf. Phil. Bot. 8, 1915, 2817; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 279; Lam, l. c. 1925, 77; Lam, l. c. 1927, 407.

Small trees, c. 7 m high. Branchlets terete, 4—7 mm in diam., glabrous, greyish brown and striate; terminal cone 9—15 mm long, brownish woolly; stipules broadly ovate-oblong, 6—11 by 3—6 mm, obtuse, crested dorsally, glabrous. *Leaves* conferred at apex of branchlets, obovately oblong to spatulate, 22—40 by 8.5—16 cm, rounded and usually short obtusely acuminate, acumen 2—5 mm long, base narrowly cuneate, shortly decurrent along adaxial side of petiole; juvenile leaves densely brownish woolly, mature ones glabrous on either side, chartaceous; midrib grooved above, crested, except in the basal part, prominent below, secondary nerves (13—)16—19 pairs, ascending at an angle of 35°—50°, straight but curved at the tips, diminishing until inconspicuous, but archingly joined in the apical nerves, prominulous and minutely grooved above, prominent below, tertiary nerves transverse, few, prominulous on either side. Petioles 1.5—3 cm, flat above, greyish-yellowish puberulous, glabrescent. *Flowers* unknown. Pedicels of fruit 1.5—2 cm long, slightly thickened at apex, yellowish tomentose, glabrescent; sepals deltoid or broadly ovate, 2—3 by 3—3.5 mm, dark brownish tomentose on outside, glabrous on inside. *Fruits* according to Elmer clustered immediately beneath the foliage and pedicels arising from short tubercles or coarse excrecences, ellipsoid, 1.5—2.5 by c. 1.2 cm, 1- or 2-seeded, pericarp thin, fleshy, crustaceous when dry, glabrous. Seeds ellipsoid, slightly smaller than the fruit, brown, nitidous,

scar narrow, 1—2 by 0.2—0.3 cm, greyish, dull, embryo exalbuminous, cotyledons thick.

Type specimen: *Elmer 13263* in PNH.

Vernacular name: Mindanao: taken (Manabo dialect).

Ecology: In humus covered clay of forested ridges at 300 m.

Distribution: Philippines.

MINDANAO, Agusan prov., Cabadbaran (Mt Urdaneta): *Elmer 13263* (BO, E, FI, G, L, NY, PNH), fr. July.

23. *P. supfianum* Schlechter, *Tropenpflanzer* 7, 1903, 469, 1 fig.; Lam, l.c. 1925, 60; Lam, l.c. 1927, 400; Lam, *Nova Guinea* 14, 4, 1932, 552 — *P. inutile* Schlechter, *Guttap. & Kautsch. Exp.*, 1911, 94, *nomen*; Krause, *Engl. Bot. Jahrb.* 58, 1923, 469, *descr.*

Trees, up to 35 m. Branchlets stout, irregularly terete, ferruginously tomentose, glabrescent; terminal cone up to 12 mm long, pale or dark ferruginously tomentose; stipules lanceolate, up to 10 by 3 mm large, apex acute, pubescent on either side, caducous. *Leaves* subconferted at apex of branchlets, obovate, (9—)16—27 by (5—)6—9 cm, apex sometimes rounded, but usually short acutely or obtusely acuminate, acumen up to 10 mm long, sometimes unequal on either side of the midrib, base cuneate, decurrent along adaxial side of petiole; glabrous above, but greyish puberulous on the midrib, ferruginously tomentose below, coriaceous; midrib grooved above, prominent below, secondary nerves 10—16 pairs, ascending at an angle of 50°—65°, straight but curved at their tips, diminishing until inconspicuous, prominulous above but distinct, prominent below, tertiary nerves transverse, distinct, prominent on either side but slightly obscured by the pubescence below. Petioles stout, 10—20 mm long, grooved above, ribbed below, with the same pubescence as the branchlets. *Flowers* solitary or in (2—)4—7-flowered clusters, axillary, pedicels angular, 10—20 mm long, with the same pubescence as the branchlets. *Sepals* broadly ovate or triangular, 4.5—5.5 by 6—7 mm, apex short obtusely acuminate, ferruginously appressedly tomentose on outside, glabrous on inside, inner sepals with glabrous and membranous margins. *Corolla* 9.5—11 mm long, ferruginously sericeous on outside, glabrous on inside, lobes elliptic-ovate, 6—7 by 2.5—3 mm, apex obtuse or truncate, reflexed in anthesis. *Stamens* 12, c. 6 mm long, filaments filiform, 3—4 mm long, glabrous, anthers linear-ovoid, 3—3.5 mm long, apex obtusely or acutely acuminate, with scattered ferruginous hairs, dehiscing extrorsely. *Ovary* subdepressedly globose, c. 2 by 2.5 mm, 6-lobed, 6-celled, densely ferruginously appressedly tomentose. Style stout, angular, 5—12 mm long, pubescent up to a half. *Fruits* known immature only, subglobose, ferruginously sericeous, glabrescent.

Type specimen: *Schlechter 13921* in B.

Lectotype specimen: *Schlechter 13921* in P.

Vernacular names: West New Guinea: sowka (Manikion), kemanak, lageliek (Mooi); Northeastern New Guinea: gemas, kinakin, tua (Amele), aban, kon, ubub (Bilia), begibip, daik, dumpahop, galus, hamip, sankai (Dumpu), fukai, gawe, goga, indo (Faita).

Ecology: In rainforests of the lowlands.

Distribution: Salawati, New Guinea, perhaps also Northern Moluccas?

SALAWATI. Kaloal: NGBW 1464 (L), tree 17 m, Oct.; ibidem: NGBW 1497 (L), tree 21 m, Oct.

NEW GUINEA. W. New Guinea, Amursira: *Atasrip* 9 (L); without known loc.: NIFS bb 1189 (BO, L), Aug.; *Atasrip* 7, 8, 23, 33, 70 (BO, L); Tami river: NGBW 828 (L), tree 32 m, Jan.; Warsamson river, E. of Sorong, primary forest on clayey soil: Iwanggin NGBW 5300, 5679 (L), trees 20–27 m, Aug./Sept.; NE New Guinea, Bismarek Mts.: *Schlechter* 13921 (G, P), imm. fr.; Sepik river: *Ledermann* 8842 (SING), fl.; in forest near Pro: *Schlechter* 20001 (B), fl. Aug., type specimen of *P. inutile* Schlechter; Ramu valley, SE of Fata Airstrip, alt. 230 m: *Saunders* 342, 368, 370, 377, 381, 544 (BRI, CAN, L, LAE), trees 10–42 m, June–Aug., all sterile; SE New Guinea, Palmer river, 2 miles below junction Black river, on lower ridges, alt. 100 m, in rainforest: *Brass* 7023 (A, L), tree 30 m, fl. June; Normanby Island, Waikaiuna, rainforest, second storey layer: *Brass* 25386 (L), tree c. 30 m, fl. white, April.

BATJAN. without known loc.: *Teysmann* (?) s.n. (BO, L), doubtful specimen.

24. *P. ottolanderi* Koorders & Valeton, Bijdr. Boomsoorten Java 1, 1894, 146; idem, Icon. Bogor. 1, 1897, t. 19; idem, Exkurs. flora Java 3, 1912, 38; Koorders & Schumann, Syst. Verz. 1, 1, 1912, Fam. 239, p. 230; Koorders & Valeton, Atlas der Baumarten 4, 1918, t. 611 and 612; Lam, l. c. 1925, 64, 256; Lam, l. c. 1927, 401; Lam, in Backer, Noodfl. Java 7, 1948, Fam. 166, p. 9.

Trees, up to 30 m. Branchlets stout, irregularly terete by the numerous scars, 9–15 mm in diam., greyish yellow or pale greyish hirsute, glabrescent; terminal cone up to 18 mm, greyish or brownish yellow or pale greyish hirsute; stipules lanceolate, up to 13 by 4 mm large, apex acute or acuminate, crested and hirsute on outside, denser in the middle than along margins, glabrous on inside, fimbriate, caducous. *Leaves* subconferted at apex of branchlets, elliptic, obovate or oblong, (17–)23–26(–46) by 8–15 (–19) cm, apex rounded or obtusely acuminate, acumen up to 4 mm long, base broadly cuneate or subrotundate, almost not decurrent; glabrous above or yellowish hirsute along midrib only, hirsute below, denser so on the nerves and midrib, coriaceous; midrib grooved and minutely crested above, prominent and rounded below, secondary nerves 16–26 pairs, ascending at an angle of c. 60°, straight but curved at their tips and diminishing until inconspicuous, rarely archingly joined or connected by some thickened tertiary nerves, grooved above, prominent below, tertiary nerves transverse, prominulous above, prominent below. Petioles 2–4 cm long, flat above but often shallowly grooved, yellowish hirsute, ultimately glabrous above. *Flowers* in 7–16-flowered, axillary clusters, pedicels angular, 20–32 mm long, yellowish or brownish woolly hirsute. *Sepals* ovate, or obovate-oblong, 4–5 by 4–5 mm, apex obtuse, yellowish or brownish woolly hirsute on outside, glabrous on inside, inner sepals with membranous and glabrous margins on outside. *Corolla* 12–16 mm long, brownish or yellowish hirsute on outside but the covered area tapering V-shaped towards the base, margins glabrous, glabrous on inside, lobes elliptic-oblong, 11–13.5 by 2.5–3.5 mm, apex obtuse. *Stamens* 12, 7–8 mm long, the epipetalous higher inserted than the alternipetalous, entirely glabrous, filaments filiform, 3.5–5 mm long, anthers oblong, 2.5–3 mm long, mucronate at apex, dehiscing introrsely lateral. *Ovary* subglobose-ovoid, c. 2.5 by 2.5 mm, 6-celled, 6-lobed, yellowish hirsute. *Style* angular, 5–8 mm long, glabrous. *Fruits* oblong-ovoid, usually slightly curved, 8–10 by 3–4 cm, 1-seeded, apex rounded,

base truncate, pericarp fleshy, glabrous. Seeds fusiform, up to 38 by 12 mm, apex obtuse, base subacute, testa thick, dark brown or black, nitidous, scar covering about half of the seed, pale brown, dull, embryo exalbuminous, radicle punctiform.

Lectotype specimen: *Koorders 10158* β in L.

Vernacular names: wuru santen, ki bengang (Java).

Ecology: In primary and secondary forests at low altitudes, up to 800 m.

Distribution: Java, Sumatra.

JAVA. Banjumas, Pelabuhan Ratus, alt. 300 m: *Koorders 10158* β (BO, L), fl.; Pringombo: *Koorders 12205* β (BO, L), fl. Sept.

SUMATRA. Sumatra East Coast, Asahan, Huta Padang, secondary forest: *Krukoff 4379* (BO, G, L, NY, SING), tree 20 m, fl. fr. Nov.; ibidem, in primary forest: *Krukoff 4433* (BO, G, L, NY, SING), tree 26 m, fl. Nov.

25. *P. maingayi* (Clarke) King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr. 17, 1905, 191; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 7; Ridley, Fl. Mal. Pen. 2, 1932, 273; Lam, l. c. 1925, 72; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 123; Lam, l. c. 1927, 402; Heyne, l. c., ed. 3, 1, 1950, 1238; Wyatt-Smith, Research Pamphlet 4, 1954, 36, fig. — *Dichopsis maingayi* Clarke in Hooker f., Fl. Br. Ind. 3, 1882, 543.

Tall up to 25 m high trees. Branchlets stout, irregularly terete, grooved, 6–10 mm in diam., ferruginously woolly-tomentose, glabrescent; terminal cone up to 18 mm long, woolly-tomentose; stipules lanceolate or linear, up to 9 by 2 mm, acuminate or acute, woolly-tomentose on outside, glabrous on inside, soon caducous. *Leaves* obovate or spathulate, (14–)20–35 by (5.5–)7–17 cm, at apex rounded, obtuse or acuminate, acumen up to 12 mm long, base narrowly to broadly acute, sometimes rounded, decurrent; glabrous above, very rarely woolly-tomentose along midrib and scattered over the surface, reddish, brownish or blackish ferruginously woolly-tomentose below, sometimes denser along midrib and secondary nerves, subcoriaceous or coriaceous; midrib grooved above, sometimes minutely crested as well, prominent and rounded below, secondary nerves 14–23 pairs, ascending at an angle of 55°–60°, straight, but rather abruptly curved near margin or leaf and sometimes grooved, prominent below, tertiary nerves slender, transverse, distinct on either side but more prominent below. Petioles (1.5–)2–4.5 cm long, grooved above at least in the apical part, thickened in the basal part, reddish brownish or blackish ferruginously woolly-tomentose, sometimes partly glabrescent. *Flowers* in 3–9-flowered, axillary clusters on one or two tuberculae, pedicels angular, 7–11 mm long, in fruit up to 20 mm long and not thickened, woolly tomentose. *Sepals* ovate, 3–3.5 by 2.5–3.5 mm, acute at apex, brownish appressedly tomentose on outside, glabrous on inside, or very rarely with a few hairs, inner sepals orbicular, rounded at apex, margin membranous, glabrous and fimbriate. *Corolla* 7–10 mm long, glabrous, lobes ovate-lanceolate, 5.5–7 by 2–2.5 mm, irregularly rounded or truncate at apex. *Stamens* 12, 6–7.5 mm long, entirely glabrous, filaments filiform, 3–3.5 mm long, anthers sagittate, 3–3.5 mm long, bifid-acuminate at apex, dehiscing extrorsely. *Ovary* disciform, c. 1 by 2 mm, 6-celled, glabrous. Style filiform, 6.5–7.5 mm long, 6-ribbed, twisted, glabrous. *Fruits* ellipsoid or subglobose, 2–3 by

1.2—2.3 cm, 1-seeded, rounded at apex, pericarp fleshy, glabrous. Seeds obovoid, 12—20 by 6—8 by 3—5 mm, rounded at apex, subobtusate at base, brown, scar covering half of the seed, embryo exalbuminous, radicle small, not exsert.

Type specimen: *Maingay* 996/2 in K.

Vernacular names: Malaya: batu, djelutung batu, gētah ketapang, gētah pereha burong, gētah simpur, jelutung, nyatoh, nyatoh tembaga, tabang, simpur, terbau-simpur.

Ecology: In lowland forests.

Distribution: Malaya.

MALAYA. Kedah, Bongsu For. Res.: *Sharin* 35170 (KEP), tree 13 m, fl. March; K. Muda Singkep For. Res.: *KEP* 59622 (KEP), tree 15 m, Aug.; Kinta Ipoh: *KEP* 65919 (KEP), tree 25 m, fr. Dec. — Perak, Chankat Serdang: *Wray* 524 (SING), fl.; Dindings, Batu Undan For. Res.: *Yahya* 34870 (KEP), tree, June; without known loc.: *Wray* 2215 (SING), fr. — Pahang, Laka Hill Forest: *Zin* 27536 (KEP), tree, Jan.; Rotan Tunggal For. Res.: *Osman* 28519 (KEP), tree 23 m, May. — Selangor, Kuala Lumpur: *Hamid* 4885 (SING), juv. fr., Sept.; ibidem, Public Gardens: *Burkill* 6333 (SING), tree, fr. Sept.; ibidem: *Ahmad* 4759 (SING), fl. Aug.; ibidem, Lake Club: *CF* 7045 (SING), tree 20 m, fl. white, Febr.; Kanchung: *Ahmad* 5709 (SING), tree, juv. fr., Nov.; Bangi Kajang For. Res.: *KEP* 21970 (KEP), tree 10 m, juv. fr. Oct.; ibidem: *Bakar* 10973 (KEP), juv. fr., Nov.; Kanching: *Walton* 14797 (KEP), tree 16 m, fr. Nov.; Bangi Kajang For. Res.: *Somerville* 14566 (KEP), tree, fl. Oct.; ibidem: *Somerville* 16463 (KEP), fl. Sept.; Kuang: *Walton* 21371 (KEP), tree, fr. Dec.; Kuala Lumpur, Weld Hill Res.: *Hamid* *CF* 877 (SING), fr. May. — Negri Sembilan, Kuala Pilah, hill: *Holttum* 9806 (A, BO, KEP, SING), tree 20 m, fr. Nov.; Tamoin: *Burkill* 3153 (BO, SING), fl. April; Mt Angsi For. Res.: *Saham* 23793 (KEP), tree 10 m, juv. fr., Nov.; Bukit Sutu: *Malvius* 1906 (SING), fr. July. — Malacca, Bukit Sunggeh For. Res.: *Ghani* 2095 (SING), fl. May. — without known loc.: *Maingay* 996/2 (K, L), fl. & fr., type specimen; ibidem: *Wray* 552 (SING), fr.

26. *P. eriocalyx* H. J. Lam, l. c. 1925, 70, f. 16; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1234; Lam, l. c. 1927, 401; Heyne, l. c., ed. 3, 1, 1950, 1234.

Trees, c. 36 m. Branchlets terete or angular, 2—6 mm in diam., brownish ferruginously hirsute, glabrescent; terminal cone up to 12 mm long, hirsute; stipules linear-lanceolate, 9—11 by 1—1.5 mm, acute at apex, hirsute on outside, glabrous on inside, caducous. Leaves scattered, ovate or obovate, 11.2—20 by 5—12 cm, short obtusely or acutely acuminate, or acute at apex, acumens up to 4 mm long, broadly cuneate at base, sometimes narrowly subtruncate according to Lam; immature leaves yellowish ferruginously tomentose-hirsute on either side, mature leaves glabrous above except sometimes along the midrib, tomentose-hirsute, subchartaceous; midrib grooved above, rounded below, secondary nerves 10—14 pairs, ascending at an angle of 55°, straight and curved at apex only, diminishing until inconspicuous near margin, prominulous above and grooved as well, prominent below, tertiary nerves slender, transverse, prominulous on either side. Petioles 1.4—3 cm long, grooved above, rounded or angular below, ferruginously hirsute. Flowers in 4—12-flowered, axillary clusters, pedicels angular, 5—9 mm long, yellowish or brownish ferruginously hirsute-villose. Sepals ovate-lanceolate, 3—4 by 2—3 mm, obtuse at apex, ferruginously hirsute-villose on outside, glabrous on inside, inner sepals slightly smaller than the outer ones, with glabrous, membranous margins. Corolla 5—6.5 mm long, glabrous on outside, ferruginously hirsute between base of stamens

and at apex, lobes oblong-elliptic, 3—4.5 by 2—2.5 mm, obtusely acuminate or truncate at apex. *Stamens* (15—)18, 3—4.5 mm long, filaments filiform, 1.5—2.5 mm long, sparsely brownish woolly-hirsute, anthers broadly deltoid, compressed, 2—3 mm long, acute, glabrous. *Ovary* conoid, c. 1.5—2 mm, 6-celled, ferruginously woolly puberulous. Style filiform, 5—7 mm long, glabrous. Immature *fruit* subglobose, at apex with a short remnant of the style.

Type specimen: *Labohm 1858* in BO.

Vernacular name: njato.

Use: The timber is used for tubs and boards. The fruit is said to be edible.

Ecology: In lowland forests.

Distribution: Borneo.

BORNEO. Balikpapan, Sungairiko: *Labohm 1858*, ex. litt., fl. Febr.; Berouw Inaran, alt. 50 m: *NIFS bb 12104* (BO, L), Oct.; Mt Sekrat, S of Sangkulirang, coral limestone rocks: *Kostermans 5904* (BO, L), tree 36 m, fl. buds July.

27. **P. barnesii** Merrill, Bur. Gvt. Lab. Publ. 6, 1903, 13; Dubard, Bull. Mus. hist. nat. 15, 1909, 383; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 278; Lam, l. c. 1925, 67; Lam, l. c. 1927, 401.

Trees, up to 40 m. Branchlets stout, 3—6 mm in diam., dark brown to greyish cinnamomously woolly, pubescence long persistent but finally branchlets glabrous; terminal cone broadly conoid, up to 5 mm long; stipules lanceolate-acicular, cartilaginous, up to 3 by 1 mm, acute, woolly without in the middle-line only, glabrous within, relatively long persistent but finally caducous. *Leaves* scattered, obovate to spatulate, 8—20 by 6—11 cm, apex rounded, entire or emarginate, base narrowly cuneate or subabruptly narrowed near petiole, decurrent along upper surface of petiole; woolly on either side but upper surface finally subglabrous, underside of midrib and nerves denser pubescent than the rest of the leaf, coriaceous to membranous; midrib grooved above, prominent and rounded below, secondary nerves 12—14 pairs, ascending at an angle of c. 45°, straight, curved at their tips only, diminishing until inconspicuous near margin of leaf, prominulous and grooved above, prominent below, tertiary nerves very slender, transverse, inconspicuous on either side. Petioles 10—18 mm long, grooved above, with a few ribs below, densely woolly-tomentose. *Flowers* in 5—10 (or more?)-flowered, axillary clusters, pedicels slender, 2.5—3.5 cm long, in fruit up to 5 cm long, woolly tomentose. *Sepals* triangular to ovate, 3—4 by 3—4 mm, apex acute, those of the inner ones obtuse, tomentose on outside, glabrous on inside and on outside along the margin of the inner sepals. *Corolla* c. 6.5 mm long, glabrous, lobes ovate-elliptic, c. 4.5 by 3 mm, apex rounded. *Stamens* 18, 3—4 mm long, entirely glabrous, filaments linear, c. 2 mm long, anthers ovoid, c. 2 mm long, acute, part of them dehiscent introrsely, the others extrorsely. *Ovary* conoid, c. 2.5 by 2.5 mm, brownish puberulous at apex only, passing gradually into the style, the latter 12—15 mm long, glabrous. *Fruits* narrowly ovoid to fusiform, sometimes slightly oblique, 3.5—4 by 1—1.4 cm, rounded at apex but with a short remnant of the style, 1-seeded, pericarp fleshy, glabrous. Seeds fusiform, c. 2.8 by 1.2 by 0.8 cm, obtuse at either end, testa thin, yellowish

brown, nitidous, scar as long as seed, c. 6 mm broad, light brown, embryo exalbuminous, radicle short, hardly exsert.

Type specimen: *Merrill 2757* in PNH.

Lectotype specimen: *Merrill 2757* in L.

Vernacular names: alakáak (Tagalog), nato (Panay Bisaya), palak-palak (Tagalog).

Ecology: In primary forests at low and medium altitudes.

Distribution: Luzon and Masbate.

LUZON. Bataan prov.: *Barnes 62* (= *FB 170*) (A), fl. Jan.; see also Merrill 1923, 278.

MASBATE. without known loc.: *Merrill 2757* (K, L, NY), fr. June.

28. *P. polyandrum* Robinson, Phil. J. Sc., Bot. 3, 1908, 212; Dubard, Bull. Mus. Hist. Nat. 15, 1909, 384; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 282; Lam, l.c. 1925, 76; Lam, l.c. 1927, 407 — *P. lepidotum* Robinson, msc. — *P. wenzelii* Merrill, msc.

Trees, c. 24 m. Branchlets stout, 7–10 mm in diam., covered with numerous leaf scars, ferruginously sericeous, glabrescent; terminal cone up to 12 mm long; stipules ovate-lanceolate, 9–12 by 3–4 mm, obtuse, crested on the back, when young ferruginously sericeous, but soon glabrous, long persistent, sometimes almost intrapetiolair. *Leaves* subconferted or conferted at apex of branchlets, obovate to oblanceolate, 21–43 by 7.5–16 cm, obtuse and short obtusely acuminate at apex, cuneate or subrotundate at base; sparsely ferruginously tomentose on either side (ultimately glabrous?), sometimes stronger so on upper side of midrib, subchartaceous; midrib broadly grooved above and minutely crested as well, prominent and rounded below, secondary nerves (10–)12–19 pairs, ascending at an angle of 40°–65°, curved or slightly S-shaped, stronger curved at their tips, archingly joined or connected by thickened tertiary nerves, prominulous above and grooved as well, prominent below, tertiary nerves slender, transverse, prominulous above, stronger so below. Petioles 1.2–3 cm long, indistinctly crested above, rounded below, glabrous. *Flowers* in 2–6-flowered, axillary clusters, in bud 7–15-flowered, pedicels angular, 15–23 mm long, greyish or ferruginously tomentose. *Sepals* broadly ovate, 4–5.5 by 4–6 mm, subacute or acuminate at apex, tomentose on outside, glabrous on inside, inner sepals with membranous and glabrous margins, fimbriate. *Corolla* 15–19 mm long, glabrous, when young shortly tomentose on outside, lobes oblanceolate, 13–16 by 3–4.5 mm, rounded or retuse at apex, fimbriate. *Stamens* 24–33, 9–11 mm long, glabrous, filaments filiform, 6–8 mm long, anthers lanceolate, 4–5 mm long, apiculate and truncate at apex, dehiscing laterally. *Ovary* broadly ovoid or discoid, c. 1.5 by 2 mm, 6–10-celled, glabrous. Style 2–3 cm long, glabrous. *Fruits* ellipsoid or ovoid, 2–2.2 by c. 1.9 cm, 1–(2–4)-seeded, pericarp thin, fleshy, glabrous. Seeds ellipsoid or obpyriform, 1.7–2 by c. 1.3 by c. 0.6 cm, testa thin, scar covering half the surface of the seed, embryo exalbuminous, radicle not exsert.

Type specimen: *Clemens 1017* in PNH.

Lectotype specimen: *Clemens 1155a* in L.

Vernacular names: bisuakan-na-kálu, (Tagaká-ólo language), tagkan (Manóbo language), tipurus (Magindaná language).

Ecology: In primary forests at low and medium altitudes up to 700 m.

Distribution: Philippines.

LEYTE. Dagami: *Ramos 15210* (K), fl. & fr. Aug.; Tacloban: *Wenzel 1724* (K), fl. buds, March; without known loc.: *Wenzel 1491* (G), fl. buds, July.

MINDANAO. Agusan prov., Cabadbaran (Mt Urdaneta): *Elmer 13660* (BO, FI, G, K, L), fr. & fl. buds, Aug.; Misamis prov.: *Miranda 17974* (K), fr. Jan./Febr.; Zamboanga prov., Malangas: *Ramos & Edaño 36901* (K), fr. Oct./Nov.; Lake Lanao, Camp Keithley: *Clemens 1155a* (BO, G, K, L), fl. & fr. Sept.

SAMAR. Mt Malignon: *Sulit 6186* (L, PNH, SING), fl. April/May.

PANAY. f. Merrill, 1923, 282.

Remarks. According to Robinson the upper side of the leaves is said to be glabrous and the lower surface very densely and minutely lepidote, or when young somewhat ferruginous-tomentose, but I am unable to confirm this.

As this type specimen became lost during the war, among the material cited by Robinson *Clemens 1155a* has been chosen to represent the lectotype specimen.

29. *P. komakomar* van Royen, n. sp.

Arbor magna. Ramuli crassi, brunneo-nigri, lanato-tomentosi, glabrescentes? Folia obovato-spathulata, 35—41 × 12—15 cm, apice rotundata vel subacute acuminata, matura supra glabra, subtus dense ferrugineo-puberula. Nervi secundarii utroque latere 17—22, sursum evanescentes, tertiarii sparsi, transversi. Petiolus 1—2.5 cm longus, nigro-brunneo-tomentosus. Pedicellus cinereo-tomentosus. Sepala 6, in utroque latere brunneo-tomentosa. Corolla sicut ovarium et stylus ignoto. Fructus immaturus ellipsoideus, 6-locularis. Typus: *Hoogland 4521* in L.

Trees, c. 30 m tall. Branchlets stout, angular, c. 8 mm in diam., brownish black woolly-tomentose, glabrescent?; terminal cone up to 2 cm long, woolly-tomentose; stipules none (always?). *Leaves* subconferted at apex of branchlets, obovate-spathulate, 35—41 by 12—15 cm, rounded and subacutely acuminate at apex, narrowly cuneate at base, tapering along sides of petiole; subcoriaceous, juvenile leaves ferruginously tomentose on either side and woolly above on midrib, mature ones glabrous above, densely ferruginously puberulous below; midrib flat above, prominent and rounded below, secondary nerves 17—22 pairs, ascending at an angle of 70°—75°, curved, diminishing until inconspicuous near margin, distinct and prominulous above, stout and prominent below, tertiary nerves sparse, transverse, recurved near midrib with a reticulate nervation in between, prominulous on either side, but more distinct below. Petioles 1—2.5 cm long, flat above, rounded below, blackish brown tomentose. *Flowers* in many-flowered clusters but no further details known. Pedicel of juvenile fruit angular, c. 2.5 cm long, greyish tomentose. Calyx in fruit up to 6 mm in diam., sepals 6, lanceolate-ovate, up to 4.5 by 2.5 mm, rounded at apex, brownish tomentose on either side. Juvenile fruit ellipsoid, c. 6 by 3 mm, with an up to 5 mm on either side. Petioles stout, 1—2.5 by 0.4—0.7 cm, flat above, rounded long, glabrous, a remnant of the style at the acute apex, 6-celled, brownish tomentose.

Type specimen: *Hoogland 4521* in L.

Vernacular names: komakomar (Wanigela), Mo'a (Onjob language, Koreaf).

Ecology: In rainforests at low altitudes.

Distribution: New Guinea.

Southeastern New Guinea, Northern distr., near Budi Barracks, Tufi subdistrict, in tall rainforest, alt. 75 m: *Hoogland 4521* (L), tree c. 30 m, fr. young, green, Aug.

Remarks. Among the New Guinean species this one is immediately to recognize by its large leaves and by the calyx with its 2-sided pubescence.

30. *P. pinnatinervium* Elmer, Leaf. Phil. Bot. 8, 1915, 2819; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 282; Lam, l. c. 1925, 55; Lam, l. c. 1927, 399.

Trees, up to 25 m. Branchlets stout, up to 8 mm in diam., glabrous; terminal cone up to 4 cm long, glabrous; stipules ovate-lanceolate, 2—3.5 by 0.8—1.4 cm, acute, acuminate or aristate, crested on the back, on outside brownish puberulous in the basal part, glabrous on inside, twisted, rather long persistent but finally caducous. *Leaves* conferted at tips of branchlets, usually pandurate, sometimes obovate-oblong, 40—52 by 12.5—17 cm, retuse, rounded or obtuse at apex, broadly cuneate at base, shortly decurrent along upper surface of petiole; scattered ferruginously puberulous above or glabrous, densely finely greyish or yellowish brown puberulous below, sub-chartaceous; midrib broadly grooved above and minutely crested as well, prominent and rounded below, secondary nerves 25—32 pairs, ascending at an angle of 65°—75°, curved, stronger so at their tips, diminishing until inconspicuous near margin, prominulous above and grooved as well, prominent below, tertiary nerves slender, transverse, rather dense, inconspicuous on either side. Petioles stout, 1—2.5 by 0.4—0.7 cm, flat above, rounded below, thickened in basal part, ferruginously tomentose. *Flowers* unknown. *Fruits* obliquely ellipsoid, 2.5—3.5 by 1.5—2 cm, obtuse, 1-seeded, pericarp thin, fleshy, ferruginously woolly, glabrescent. Seeds broadly ellipsoid, laterally compressed, c. 1.5 by 1.2 by 1 cm, rounded at either end, scar covering about $\frac{1}{4}$ of the surface of the seed, blackish, embryo exalbuminous, radicle not exsert. Pedicels in fruit 3—5 cm long, ferruginously tomentose.

Type specimen: *Elmer 13896* in PNH.

Lectotype specimen: *Elmer 13896* in L.

Vernacular name: tagkan (Manóbo language).

Ecology: In primary forests up to 900 m altitude.

Distribution: Philippines.

MINDANAO. Agusan prov., Mt Urdaneta: *Elmer 13896* (BO, E, FI, G, L, NY), tree 20—25 m, fr. Sept.

Remarks. Resembles *P. gigantifolium* Merrill but differs in the pandurate leaves, the pubescence on the underside of leaves, and in the longer pedicels, especially in fruit.

As the type specimen in the Manila Herbarium became lost during the war a lectotype specimen is chosen from among the original material distributed to other herbaria.

31. *P. decurrens* H. J. Lam, l. c. 1925, 51, f. 8; Lam, l. c. 1927, 398.

Trees? Branchlets subterete to angular, 8—12 mm in diam., brownish sericeous, glabrescent; terminal cone 8—10 mm long, greyish and brownish sericeous; stipules lanceolate, up to 8 by 3 mm, acute, greyish and brownish sericeous, caducous. *Leaves* conferted at tip of branchlets, obovate, 20—35

by 9—13 cm, apex acute, shortly acuminate, rounded or emarginate, base narrowly cuneate, decurrent along upper side of petiole; glabrous above except greyish velutinous along midrib and scattered hairs on the surface, cinnamomously sericeous below, chartaceous-membranous; midrib narrowly grooved above in the basal, broadly grooved in the apical part, secondary nerves 20—25 pairs, ascending at an angle of 50° — 60° , straight, curved at their tips only, diminishing until inconspicuous, minutely grooved above, prominent and rounded below, tertiary nervation transverse, prominulous on either side. Petioles 2—3.5 cm long, minutely grooved in the apical part, flat in the basal part, cinnamomous-brown or greyish sericeous, sometimes sparsely so. *Flowers* in few-flowered, axillary clusters, pedicels angular, c. 1.5 cm long, pubescent, in fruit up to 2.5 cm long, thickened at apex. *Sepals* lanceolate, c. 5 by 3 mm, rounded, ferruginously sericeous on outside, glabrous on inside, inner sepals narrower than outer ones, all sepals reflexed in fruit. *Corolla* up to 2 cm long, lobes lanceolate, c. 6.5 by 2 mm, apex obtuse, base on outside appressedly tomentose. *Stamens* 12, glabrous, c. 4.5 mm long, filaments subulate, c. 1 mm long, anthers ovoid, 3—4 mm long, apex obtusely acuminate, dehiscent laterally. *Ovary* subglobose, c. 1.5 by 2 mm, 6-celled, brownish pubescent at apex. Style subulate, 7—8 mm long, glabrous. *Fruits* ellipsoid to subobovoid, 2—3 by 1.5—2 cm, subacuminate, apex rugose, narrowed at base, 1-seeded, pericarp fleshy, glabrous. Seeds subglobose-ellipsoid, c. 2 by 1.5 cm, testa cartilaginous, scar covering half of the seed, dull, embryo exalbuminous, cotyledons thick, rugose-like on outside.

Type specimen: *Hallier 357* in BO.

Distribution: Borneo.

BORNEO. Indonesian Borneo, Lumukutan Island: *Hallier 357* (BO, L, NY), fl. & fr.

Remark. The fruit has been described after the Leiden material.

32. *P. stipulare* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 21; Lam, l.c. 1925, 57; Lam, l.c. 1927, 399 — *P. richardsii* K. Griffioen & H. J. Lam, Kew Bull. 1927, 1927, 17.

Trees, c. 24 m. Branchlets stout, (5—)8—10(—12) mm in diam., with distinct scars of stipules, leaves and flowers, cinnamomously tomentose, glabrescent; terminal cone up to 14 mm long; stipules squamiform, up to 12 by 6 mm, obtuse or acute, tomentose on outside in the central part only, glabrous on inside, caducous. *Leaves* scattered, broadly obovate, 14—29 by 7.5—16 cm, rounded at apex, broadly cuneate at base, shortly decurrent along upper side of petiole; glabrous above except sparsely whitish tomentose along the midrib and a few scattered hairs on the surface, yellowish brown appressedly tomentose below, subcoriaceous; midrib broadly grooved above, prominent and rounded below, secondary nerves 15—20 pairs, ascending at an angle of c. 55° , straight, curved near margin and diminishing until inconspicuous, prominulous above, prominent below, tertiary nerves slender, transverse, inconspicuous above, indistinct or invisible below by the pubescence. Petioles 18—23 mm long, grooved above, cinnamomously tomentose. *Flowers* in 2—6-flowered, axillary clusters, pedicels terete, angular at apex. 2—6 cm long, cinnamomously tomentose. *Sepals* 6 or 7, the 3 or 4 inner

ones larger than the outer ones, the latter ovate-elliptic, 5.5—8 by 5.5—7.5 mm, subacute at apex, ferruginously or cinnamomously appressedly tomentose on outside, glabrous on inside, the inner sepals ovate, 9—10 by 6—7.5 mm, obtuse, slightly crested on outside, margins glabrous and membranous. *Corolla* up to 18 mm long, whitish tomentose on outside on the tube and the central part of the lobes, glabrous on inside, lobes elliptic-oblong, up to 16 by 6 mm, obtuse. *Stamens* 22—27, up to 10 mm long, filaments lanceolate-oblong, 2—3.5 mm long, whitish tomentose, anthers narrowly sagittate, 5.5—7 mm long, apex aristulate, sparsely ferruginously pubescent, dehiscing extrorsely or laterally. *Ovary* ovoid, c. 2 by 2 mm, 8—12-celled, cinnamomously pubescent, at base with an annular disk. Style filiform, up to 20 mm long, glabrous except at base. *Fruits* unknown.

Type specimen: *Beccari 1549* in P.

Ecology: In forests at low altitudes.

Distribution: Borneo.

BORNEO. Sarawak, Mattang: *Beccari 1549* (FI, P), fl. May; Mt Dulit, near Long Kapa: *Richards 2605* (L, SING), tree 24 m, fl. white, Febr., type specimen of *P. richardsii* Gr. & Lam.

33. *P. herveyi* King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr. 17. 1905, 197; Ridley, Fl. Mal. Pen. 2, 1923, 276; Lam, l. c. 1925, 38; Lam, l. c. 1927, 395; Wyatt-Smith, Research Pamphlet 4, 1954, 35.

Trees, up to 45 m. Branchlets angular, 2—2.5 mm in diam., greyish or greyish ferruginous puberulous, glabrescent; terminal cone up to 3 mm long, puberulous; stipules triangular-lanceolate, c. 3 by 1.5 mm, acute at apex, ferruginously tomentose on outside, glabrous on inside, caducous. *Leaves* subconfert at tip of branchlets, broadly obovate, 5—9 (—12) by 3.2—5 cm, rounded, shortly obtusely acuminate at apex, cuneate at base, decurrent along sides of petioles; sparsely greyish puberulous above along midrib and secondary nerves, glabrescent, sparsely ferruginously puberulous below, subcoriaceous; midrib angular on either side, or grooved above and/or rounded below, secondary nerves 5—9 pairs, ascending at an angle of 45°, curved, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves transverse, very slender, inconspicuous above, hardly visible below. Petioles 0.8—2 cm long, crested or flat above, rounded below, sparsely rusty or greyish pubescent, subglabrescent. *Flowers* in 2—6-flowered, axillary clusters, pedicels angular, ferruginously tomentose. *Sepals* ovate, 2—2.5 by 1.5—1.7 mm, subobtuse at apex, ferruginously puberulous-tomentose on outside, glabrous on inside, plumose at apex, inner sepals lanceolate-ovate, c. 2 by 1.5 mm, obtuse, glabrous on outside along the membranous, fimbriate margins, otherwise similar to the outer ones. *Corolla* c. 4 mm long, on outside ferruginously sericeous on tube and base of lobes, on inside hirsute between the filaments, lobes oblong-ovate, c. 3.5 by 1.5 mm, rounded and plumose at apex, patent in anthesis. *Stamens* 12, 3—5 mm long, filaments filiform, 1—2 mm long, glabrous, anthers ovoid-oblong, c. 1.5 mm long, truncate-acuminate at apex, ferruginously hirsute, dehiscing extrorsely. *Ovary* subglobose, c. 0.7 by 1 mm, very sparsely ferruginously tomentose. Style subulate, 5—7.5 mm long, glabrous. *Fruits* ellipsoid, 9—13 by 7—9 mm, 1-seeded, obtuse, pericarp thick, glabrous.

Seeds fusiform, c. 7 by 2.5 mm, blackish, scar covering half of seed, greyish.

Type specimen: *Hervey s.n.* in K.

Vernacular name: nyatoh putih.

Ecology: In rainforests at low altitudes.

Distribution: Malaya.

MALAYA. Malacca, without known loc.: *Hervey s.n.* (K), fl.; Bukit Sedaman For. Res.: *Bakar 25321* (KEP), tree 11 m, Nov. — Perak, Ijok For. Res.: *KEP 65553* (KEP), tree 26 m, Aug.; P. Tanjong For. Res.: *Larut 13238* (KEP), tree 20 m, May; without known loc.: *Aziz Budin 363* (KEP), tree 16 m, fr. Febr.; *Symington 37370* (KEP), Aug.; *Symington 37879* (KEP), Aug.; *Symington 68152* (KEP), Oct. — Negri Sembilan, Senaling Inas For. Res.: *Ibrahim 42821* (KEP), tree 45 m, Nov. — Pahang, Kuantan, Bukit Beserat For. Res.: *KEP 65684* (KEP), tree 36 m, Jan. — Selangor, Ulu Gombak For. Res., Kuala Lumpur, *Zainuddin Tuah 75873* (KEP, L), tree 2 m, fl. buds Nov.

34. *P. elliptilimum* Merrill, Phil. Journ. Sc. 27, 1925, 46; Merrill, Enum. Phil. Fl. Pl. 4, 1926, 253; Lam, l. c. 1927, 412.

Trees. Branchlets terete, up to 5 mm in diam., minutely golden-brown pubescent, glabrescent; terminal cone up to 7 mm long, greyish puberulous; stipules lanceolate, up to 5 by 1.5 mm, acute, pubescent on outside, glabrous on inside, caducous. *Leaves* scattered, elliptic, 6—12 by 3—7 cm, rounded or obtusely acuminate at apex, cuneate at base and shortly decurrent along upper side of petiole; glabrous above, golden-brown tomentose below when young but soon glabrous, coriaceous; midrib broadly grooved above and minutely crested, prominent and rounded below, secondary nerves 8 or 9 pairs, ascending at an angle of c. 45°, curved, stronger so at their tips, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves transverse, slender, grooved above, prominulous below. Petioles 1.5—3 cm long, narrowly grooved above, rounded below, glabrous. *Flowers* in 3—7-flowered, axillary clusters, pedicels angular or rounded, 2—2.5 cm long, yellowish appressedly puberulous. *Sepals* ovate to broadly ovate, 3—4 by 2.5—3.5 mm, rounded or obtuse at apex, ferruginously tomentose on outside, glabrous on inside, inner sepals with glabrous and membranous margins, sparsely fimbriate. *Corolla* 8—10 mm long, glabrous on either side, lobes ovate-elliptic, 5—6.5 by 2.5—3.5 mm, obtuse or sub-obtuse at apex. *Stamens* 12, 5—6.5 mm long, filaments subulate, 2—3 mm long, glabrous, anthers ovoid, 3.5—4 mm long, ferruginously hirsute, dehiscent extrorsely. *Ovary* ovoid, c. 1.5 by 2.5 mm, 6-celled, 6-lobed, glabrous, style filiform, 6-ribbed, up to 11 mm long, glabrous. *Fruits* unknown.

Type specimen: *Loher 13867* in PNH.

Leotype specimen: *Loher 13867* in K.

Distribution: *Luzon, Polillo*.

LUZON. Prov. Rizal, Montalban: *Loher 13867* (K), fl. April.

POLILLO ISLAND. Anibawan: *Castro PNH 6517* (A, L, PNH, SING), tree 7 m, fl. Dec.

35. *P. crassifolium* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 23; Lam, l. c. 1925, 35; Lam, l. c. 1927, 391.

Trees? Branchlets subterete, 2—2.5 mm in diam. (or more?), brownish pilose but soon glabrous; terminal cone up to 5 mm long; stipules lanceolate,

up to 4 by 2 mm, apex acute, pale brownish tomentose on outside, ferruginously woolly on inside, caducous. *Leaves* scattered, obovate to elliptic-obovate, 8—10 by 3—2.6—5 cm, apex obtuse to very slightly obtusely acuminate, base cuneate, shortly decurrent along adaxial side of petiole; glabrous above, scattered whitish puberulous below, thin-coriaceous; midrib prominulous above, prominent and rounded below, secondary nerves 6 or 7 pairs, ascending at an angle of (35°—)40°—45°, straight and curved at their tips only, diminishing until inconspicuous, prominulous above, prominent below, tertiary nerves transverse, few, indistinct on either side. Petioles 10—16 mm long, flat above, slightly thickened and rugulose in the basal part, ferruginously pilose, glabrescent. *Flowers* in 2- or 3-flowered, axillary clusters, pedicels 3—7.5 mm, ferruginously tomentose. *Sepals* 4 or 5, ovate, 2—2.5 by 1.8—2.2 mm, obtusely acuminate, ferruginously tomentose on outside, glabrous on inside, inner sepals ciliate along margin. Corolla and stamens not seen but according to Pierre's description and drawings: "*Corolla* 6.5 mm long, tube 2.5 mm, lobes 4 or 6, elliptic-spathulate, c. 4.2 by 2.2 mm, obtuse, margins pilose, villose between the stamens, otherwise glabrous. *Stamens* usually 12, sometimes 9, inserted at the base of the lobes, 4.2—4.6 mm long, filaments subulate, 2—2.3 mm, villose, anthers cordate-ovate, 2—2.4 mm, apex apiculate, sparsely hairy." *Ovary* compressedly globose, c. 1 by 2 mm, glabrous, 6-celled. Style filiform, 6—8 mm long, glabrous. *Fruits* unknown.

Type specimen: *Beccari 2099* in P.

Distribution: Borneo.

Sarawak, without loc.: *Beccari 2099* (FI, P), fl.

36. *P. multiflorum* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 23; Lam, l.c. 1925, 91, f. 25; Lam, l.c. 1927, 410; Jeuken, Blumea 6, 3, 1952, 579 — *Isonandra emarginata* H. J. Lam, l.c. 1927, 420, f. 8; Jeuken, l.c., 578.

Trees, c. 8 m high. Branchlets slender, angular, 1.5—3 mm in diam., ferruginously sericeous but rather soon glabrous; terminal cone c. 3 mm long, ferruginously sericeous, cone sometimes replaced by flowers; stipules triangular-lanceolate, c. 1.5 by 1 mm, apex acute, sericeous on outside, glabrous on inside. *Leaves* scattered, elliptic, obovate or obovate-rotundate, 3—5(—9.5) by 1.5—3(—4.5) cm, apex rounded, emarginate or short obtusely acuminate, base broadly cuneate, subabruptly narrowed near petiole, decurrent along sides or petioles; young ones ferruginously mainly on the nerves, mature ones glabrous, coriaceous; midrib crested above, prominent and rounded below, secondary nerves 5—7 pairs, curved, ascending at an angle of c. 65°, diminishing until inconspicuous near margin, prominulous or grooved above, prominulous below, tertiary nerves slender, transverse, few, hardly visible above, prominulous below. Petioles 7—9 mm long, flat or broadly grooved above, greyish tomentose when young, mature ones glabrous. *Flowers* in 3—7-flowered, apical or axillary clusters, pedicels angular, 5—8 mm long, ferruginously tomentose. *Sepals* 5, 6 or 7, in 2 whorls of 3, or imbricate, ovate, c. 1.5 by 2 mm, apex subobtuse, ferruginously tomentose on outside, whitish tomentose on inside, inner sepals with membranous margins, on inside sparsely puberulous or almost glabrous.

Corolla seen in bud only, c. 2 mm long, glabrous on either side, lobes ovate-elliptic, c. 1.5 by 1 mm, apex obtuse. *Stamens* 9, 10 or 11—13, c. 1 mm long, filaments subulate, c. 0.8 mm long, glabrous, curved downwards at apex, anthers lanceolate, c. 0.6 mm, apex rounded or truncate, ferruginously tomentose, alternipetalous stamens shorter than the epipetalous. *Ovary* ellipsoid, c. 1 by 1 mm, 4—6-celled, ferruginously hirsute. Style subulate, c. 1.2 mm long, glabrous. *Fruits* not seen but according to Lam 1927: "ovoid, c. 1.5 by 1 cm, subacute at apex, glabrous, with a short remnant of the style at apex. Seeds unknown."

Type specimen: *Beccari 1439* in P.

Ecology: In rainforests at low altitudes.

Distribution: Borneo.

BORNEO. Sarawak, Mattang: *Beccari 1439* (FI, G, L, NY, P, S); near Kuching: *Haviland 1890* (BM, L), fl.; Sungei Ramnungan: *Omar 114* (f. Lam 1927), tree 18 m, fr. Sept.; without known loc.: *Beccari 2490* (G), doubtful specimen.

Remark. The specimens mentioned by Lam 1925, 91, do not belong to this species but represent *Palaquium ridleyi* King & Gamble. The drawing therefore included in Lam's paper also refer to that species.

37. *P. walsurifolium* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 22, sphalm. *walsuraefolium*; Lam, l.c. 1925, 77, 256, f. 20; Lam, l.c. 1927, 407; Heyne, Nutt. Pl. Ned-Indie, ed. 3, 1, 1950, 1241.

Trees, up to 37 m, with stiltroots. Branchlets slender, 2—3.5 mm in diam., greyish ferruginously tomentose, glabrescent; terminal cone up to 4 mm long, ferruginously tomentose; stipules triangular-lanceolate, up to 3 by 2.5 mm, acute, tomentose on outside, but glabrous along the margins, glabrous on inside, caducous. *Leaves* scattered or subconferted at tip of branchlets, obovate or rounded-obovate, 4—9.5 by 2—4.5 cm, rounded or sometimes short obtusely acuminate at apex, long decurrent along upper side of petiole; subcoriaceous, glabrous on either side, but when immature yellowish brown pubescent below but soon entirely glabrous, subcoriaceous; midrib subimpressed above, prominent and rounded below, secondary nerves 7—10 pairs, ascending at an angle of c. 60°, curved, diminishing until inconspicuous near margin of leaf, grooved above, prominent below, tertiary nervation transverse, invisible to inconspicuous above, prominulous below. Petioles 10—25 mm long, broadly grooved or flat above, thickened in the basal half, ferruginously or greyish tomentose when young but soon entirely glabrous. *Flowers* in 2—4-flowered, axillary clusters, pedicels terete, 3.5—7 mm long, in fruit 13—20 mm, ferruginously tomentose. *Sepals* suborbicular or ovate, 2.5—3.5 by 2—2.5 mm, obtuse or obtusely subacuminate, ferruginously or greyish puberulous on outside, but glabrous along the fimbriate margin and on inside, inner sepals more elliptic than outer ones. *Corolla* glabrous on either side (according to Lam, 1925 only slightly villose in the throat), 6—7 mm long, lobes ovate-elliptic, up to 4 by 2 mm, obtuse. *Stamens* 12, c. 3.5 mm long, filaments filiform, c. 2.5 mm long, widened at base, glabrous or slightly woolly at base, anthers ovoid-ellipsoid, 1—1.5 mm long, rounded and bifid at apex, glabrous, dehiscing lateral-extrorsely. *Ovary* discoid, c. 0.5 by 1.5 mm, pale ferruginously tomentose. Style filiform, 5—8 mm long, glabrous. *Fruits* globose or ellipsoid, 1—2 cm in diam.,

1-seeded, obtuse or subobtuse, sometimes with a short remnant of the style, pericarp fleshy, glabrous. Seeds ellipsoid, 7—14 by 5—7 mm, scar linear, covering about $\frac{1}{3}$ of the surface of the seed, greyish, embryo exalbuminous, radicle small, not exsert.

Type specimen: *Beccari 557* in P.

Vernacular names: Malaya: bunga tanjong, nyatoh kelalang; Sumatra: balam putih, b. sĕrĕndit, b. sudu, b. tambaga; Borneo: beitis, mergetahan, njatoh babi, njatoh jangkar.

Ecology: Growing in marshy forests at low altitudes or on peaty, never inundated soils.

Distribution: Malaya, Sumatra, Borneo.

MALAYA. Mt Sedili For. Res.: *Omar 52* (SING).

SUMATRA. Bengkalis, Kempastinggi: *NIFS bb 24445* (BO, L, SING), June; ibidem: *NIFS bb 24448* (BO, L, SING), June; Rantau Pandjang: *NIFS 24440* (BO, L), May; Kelapali: *NIFS bb 25251* (BO, L), fr. Aug.; Palembang, Lematang Ilir, alt. 100 m: *NIFS bb 31981* (BO, L), fl. buds June; without known loc.: *Daud 11335* (K, SING), tree 30 m, fr.

BORNEO. Sarawak, Kuching: *Beccari 557* (FL, G, L, NY, P, S), fr. Sept.; Setapok For. Res., low-lying forest: *Carroll 7172* (SING), fr. Febr.; ibidem: *SAR 4773* (L, SAR), tree 14 m, June — Indonesian Borneo, Preihari, Kintap, alt. 150 m: *NIFS bb 12888* (BO, L), fl. Sept.; Sibul, Rejang river: *Haviland 1875* (K, L), fl. & fr. Oct.

38. *P. macrocarpum* Burek, Ann. Jard. bot. Btzg 5, 1886, 32, t. 10, f. 5 & 6; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 17; Lam, l. c. 1925, 79, f. 21 and 22; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1237; Lam, l. c. 1927, 408; Heyne, l. c., ed. 3, 1, 1950, 1237 — *Treubella macrocarpum* (Burek) Pierre, Not. bot. Sapot., 1891, 5; Boerlage, Handl. Fl. Ned.-Ind. 2, 1, 1891, 310.

Trees, up to 45 m. Branchlets angular, 3—5 mm in diam., puberulous at apex, otherwise glabrous; terminal cone up to 6 mm long, puberulous; stipules lanceolate, up to 3 by 1.5 mm long, acute, puberulous on outside, but glabrous along the margins, glabrous on inside, caducous. *Leaves* scattered, or subconferted at tip of branchlets, obovate, elliptic or oblong, sometimes ovate-oblong, 8—13(—25) by 3.5—6(—10) cm, short or long obtusely acuminate, acumens up to 3 mm long, base broadly cuneate, rarely rounded, shortly decurrent along upper side of petiole; glabrous above, sparsely finely ferruginously tomentose below, but ultimately glabrous, coriaceous; midrib shallowly grooved above, rounded below, secondary nerves 8—12 pairs, ascending at an angle of c. 55°, curved, diminishing until inconspicuous near margin, prominulous above, prominent below, tertiary nerves slender, transverse, prominulous but distinct on either side. Petioles 1.6—3.5 cm long, narrowly grooved above, prominent below, puberulous. *Flowers* in 5—8-flowered, axillary clusters, sometimes in two groups of 6 or more flowers, pedicels subangular, 5—13 mm long, ferruginously appressedly puberulous. *Sepals* ovate-triangular, 2—3 by 2—3 mm, subobtuse to acute, ferruginously puberulous on outside, glabrous on inside, inner sepals more roundish, with membranous and glabrous margins, fimbriate. *Corolla* 8—10.5 mm long, glabrous or rarely with a few scattered hairs on outside of lobes, the latter ovate-oblong, 6—7.5 by 2.5—3 mm, subacuminate or obtuse, recurved when in flower. *Stamens* 12, 5—6.5 mm long, filaments

3—4 mm long, glabrous, anthers oblong-ovoid, 2.5—3 mm long, acuminate, sparsely ferruginously sericeous, dehiscent extrorsely. *Ovary* semi-globose, c. 1 by 1.5 mm, 6-celled, 12-lobed, ferruginously puberulous, at base surrounded by a thick, annular, glabrous disk. Style slender, 6-grooved, 1.5—2 cm long, glabrous. *Fruits* ovoid or ellipsoid, up to 11 by 9 cm, 1—3-seeded, rounded or obtuse at apex, pericarp fleshy, glabrous. Seeds ellipsoid or ovoid when solitary, rounded at either end, 3.5—6 by 2.5—3 by 1.8—2.3 cm, testa thick, brown, scar covering almost the entire seed, grey, seeds when more together laterally compressed and scar smaller than in the solitary seeds; embryo with strongly wrinkled surface, exalbuminous, radicle short, not exsert.

Type specimen: *Teysmann s.n.* (cultivated as *IV. B. 12*) in BO.

Vernacular names: Malaya: njatu hitam; Sumatra: balam, balam mayang, balam epung, njato kaju balam, njato sudu sudu, pientek kaju, pintak kaju, punti, punti kaju.

Ecology: In primary forests at low altitudes, up to 1000 m.

Distribution: Sumatra, Malaya, Batjan, probably also Amboina and Celebes?

SUMATRA. Tapanuli, Sibolga, Barus, alt. 25 m: *NIFS bb 31569* (BO, L) — Indragirian Uplands, Pagarumbei, Tjenako river: *NIFS bb 26078* (BO, L), Oct.; without known loc. and later cultivated in Hortus Bogoriensis: *Teysmann s.n.* (= *HB IV. B. 12*) (BO, NY, SING), fl. — Sumatra West Coast, Taram, Bukit Pantai, alt. 508—600 m: *Meyer 7154, 7161* (L), tree 4 m, fl. buds July; ibidem, sandstone region of Tjampo river, alt. 500—1000 m: *Meyer 6802* (L), tree, fl. buds Aug.

MALAYA. Perak, Ulu Kenderong Grik: *Hamid 11032* (KEP, SING), tree 30 m — Singapore, Botanical Gardens: *Nur 1492* (SING) March.

BATJAN. without known loc.: *de Fretes 5616* (BO, L).

CELEBES. f. Lam, 1925, dubious specimen.

AMBOINA. f. Lam, 1925, dubious specimen.

39. *P. vexillatum* van Royen, n. sp. — Fig. 6.

Arbor magna. Ramuli graciles, ferrugineo-sericei, glabrescentes; stipulae lineares, acutae, caducae. Folia ovata, ovato-elliptica, elliptico-obovata vel obovata, 5.5—11 × 2.5—6 cm, apice anguste obtuse acuminata, supra glabra, subtus sparse ferrugineo-tomentosa. Nervi secundarii utroque latere 8—10, sursum evanescentes, tertiarii transversi. Petiolus 1.4—2.3 cm longus, sparse ferrugineo-sericeus. Pedicellus 0.15—0.3 cm longus, ferrugineo-sericeo-tomentosus. Sepala 6, extus ferrugineo-tomentosa, intus glabra. Corolla glabra, sed apice loborum fimbriata. Stamina 12; filamenta glabra; antherae dense ferrugineo-sericeae. Ovario 6-loculare, sparse ferrugineo-sericeum; stylus glaber. Fructus ignotus. Typus: *Kosterman 7325* in L.

Trees, c. 35 m tall. Branchlets slender, angular, 2—4 mm in diam., ferruginously sericeous, relatively soon glabrous; terminal cone up to 7 mm long, with the same pubescence as the branchlets; stipules linear, lax, 6—9 mm long, acute, twisted, with long ferruginous hairs on outside, glabrous on inside, caducous. *Leaves* scattered, ovate, ovate-elliptic, elliptic-obovate or obovate, 5.5—11 by 2.5—6 cm, narrowly obtusely acuminate at apex, acumen 2—5 mm long, base broadly cuneate, decurrent along sides of petioles; glabrous above, scattered ferruginously tomentose below, chartaceous; midrib grooved above and minutely crested as well, rounded and prominent below, secondary nerves slender, 8—10 pairs, ascending at an angle of c. 55°, slightly curved but stronger so at their tips and diminishing until inconspicuous along the margin, prominulous on either side, tertiary

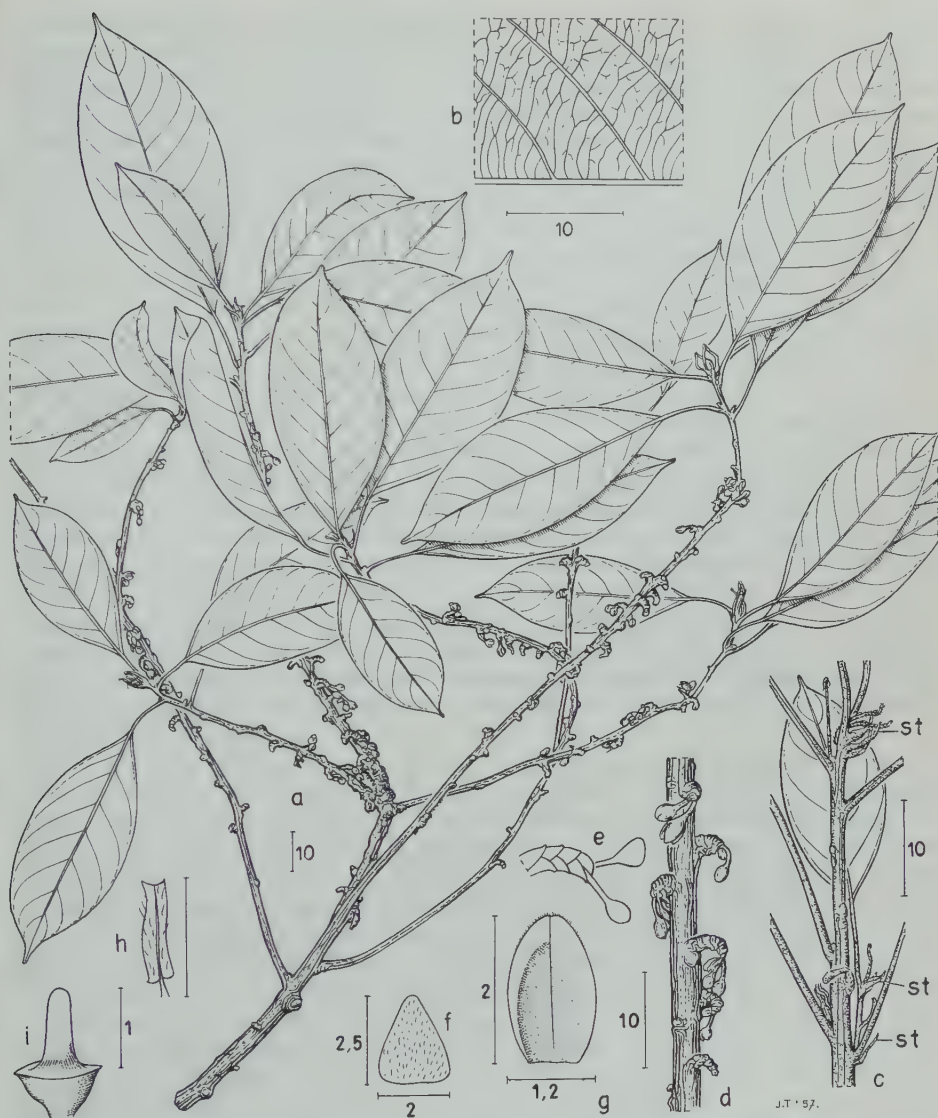


Fig. 6. *P. vexillatum*, a, branchlet with leaves and flowerbuds; b, tertiary nervation of leaf; c, apex of branchlet showing stipules (st); d, part of branchlet with inflorescences; e, part of inflorescence; f, outer sepal, outside; g, inner sepal, inside; h, stamen; i, gynaecium (*Kostermans 7325*, in a. and d. pubescence omitted).

nerves slender, transverse, prominulous on either side. Petioles 1.4–2.3 cm long, grooved above, rounded below, sparsely ferruginously sericeous. *Flowers* in 2–4-flowered, axillary clusters or along an up to 5 mm long brachyblast with scars of bracts, pedicel 1.5–3 mm long, terete, ferruginously appressedly tomentose. *Outer sepals* triangular-ovate, c. 2.5 by 2 mm, subacute, ferru-

ginously tomentose on outside, glabrous on inside, inner sepals elliptic-ovate, c. 2 by 1 mm, rounded at apex, with glabrous, membranous and fimbriate margins. *Corolla* known in bud only, c. 2 mm long, entirely glabrous except fimbriate at apex, lobes elliptic, c. 1.5 by 1 mm, rounded or obtuse at apex. *Stamens* seen in bud only, 12, in 2 distinct whorls, c. 1 mm long, filaments subulate, glabrous, anthers ovoid, c. 0.8 mm long, bifid at apex, densely ferruginously sericeous, dehiscing extrorsely. *Ovary* disciform-ovoid, c. 0.5 by 1 mm, sparsely ferruginously sericeous. Style clavate, c. 1 mm long, glabrous. *Fruits* unknown.

Type specimen: *Kostermans 7325* in L.

Vernacular name: njato.

Ecology: In forests at c. 600 m altitude.

Distribution: Borneo.

Indonesian Borneo, Peak of Balikpapan, Beoul, alt. 600 m, on sandstone: *Kostermans 7325* (BO, L), tree 35 m, fl. buds brown, July.

Remarks. The most striking of all details which distinguishes this species against all other species, except *P. simun* from New Guinea, are the long, slender, twisted stipules which protrude from the terminal cone like small flags. From this flag-like appearance of these stipules the specific epithet has been derived. From *P. simun* this new species differs in the smaller number of secondary nerves of the leaves (8—10 against 10—12), in the much longer petiole (1.4—2.3 cm against 0.5—0.8 cm), in the sparse pubescence of the underside of the leaves and in the glabrous corolla.

In appearance this species resembles *P. ridleyi* of which, however, it differs by the much longer stipules and the bifid apex of the anthers.

40. *P. lisophyllum* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909. Mém. 16, p. 7; Lam, l.c. 1925, 73; Lam, l.c. 1927, 403.

Trees. Branchlets terete, 2—4 mm in diam., brownish ferruginously pubescent, glabrescent, greyish and grooved; terminal cone up to 7 mm long, brownish ferruginously pubescent; stipules lanceolate, 4—6 mm long, apex acute, brownish ferruginously pubescent, caducous. *Leaves* scattered, oblong-elliptic, 15—19 by 6—8 cm, apex obtusely acuminate, acumen 2—5 mm, base broadly cuneate to rounded, shortly decurrent along the adaxial side of the petiole, glabrous above, scattered brownish tomentose below but denser and sericeous on the midrib, papyraceous; midrib prominulous above, prominent and rounded below, secondary nerves c. 13 pairs, ascending at an angle of (50°—)60°—65°, curved, diminishing until inconspicuous, prominulous above and shallowly grooved, prominent below, tertiary nerves transverse, slender, rather numerous, distinct on either side but prominulous. Petioles 16—19 mm long, flat above and crested, brownish ferruginously puberulous. *Flowers* solitary or in up to 4-flowered, axillary clusters, pedicels up to 3 mm long, brownish ferruginously puberulous. *Sepals* ovate, 4—5 by 3—3.5 mm, obtuse, brownish puberulous on outside, glabrous on inside, outer sepals woolly at apex, margin of inner sepals fimbriate in the basal part. *Corolla* 4—5 mm long, glabrous on outside, ferruginously tomentose on inside between the stamens, lobes elliptic, 2.5—4 by 2.5—3 mm, obtuse. *Stamens* 11 or 12, c. 2.5 mm long, filaments stout, c. 0.5 mm long, with long ferruginous hairs, anthers sagittate, c. 2 mm long, acute or bifid,

dehiscing extrorsely. *Ovary* obovoid, c. 1 by 1.5 mm, 6-celled, 12-lobed, glabrous in the basal part, ferruginously puberulous in the apical part. *Style* subulate, c. 4 mm long, with 6 lighter coloured stigmas at apex, ferruginously puberulous at the base. *Fruits* unknown.

Type specimen: *Beccari 3286* in FI.

Distribution: Borneo.

BORNEO. Sarawak, Marop: *Beccari 3286* (FI), fl. April.

41. *P. petiolare* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 9; Lam, l.c. 1925, 107; Lam l.c. 1927, 414 — *Dichopsis petiolaris* Thwaites, Enum., 1864, 176; Bentham & Hooker, Gen. Pl. 2, 1876, 658; Clarke in Hooker f., Fl. Br. Ind. 3, 1882, 541 — *Bassia petiolaris* (Thwaites) Beddome, For. Man., 1871, 140; Beddome, Fl. Sylv., 1869—1873, t. 254.

Tall trees. Branchlets terete, 4—7 mm in diam., glabrous (always?); terminal cone ovoid, up to 6 mm long, greyish puberulous; stipules lanceolate, up to 3 by 1.5 mm, acute, greyish puberulous on outside, glabrous on inside, caducous. *Leaves* scattered, broadly elliptic or elliptic-obovate, (9—)10—14 by (3—)4.5—6.5 cm, apex subabruptly obtusely acuminate, acumen 2—6 mm long, base narrowly cuneate, contracted and long decurrent along sides of petioles; glabrous on either side, subcoriaceous; midrib sub-impressed above, prominent and subangular below, secondary nerves 13—16 pairs, ascending at an angle of 60°—65°, slightly curved, stronger so at their tips and diminishing until inconspicuous, grooved above, prominent below, tertiary nerves transverse, grooved above, distinct but prominulous. Petioles 1.5—4 cm long, flat above, angular or subangular below, glabrous. *Flowers* solitary or 2—5 in each axil of leaf or scar, pedicels angular, 2.5—3 cm long, ferruginously tomentose. *Sepals* ovate, 5.5—7 by 4—5.5 mm, obtuse at apex, ferruginously tomentose-sericeous on outside, glabrous on inside except along the margins, inner sepals with membranous and glabrous margins, fimbriate along outer edge. *Corolla* 9—11.5 mm long, glabrous on outside, ferruginously pilose in throat, lobes ovate-lanceolate, 5.5—7.5 by 2.5—3 mm, obtuse at apex. *Stamens* 12, 5—7.5 mm long, filaments filiform, 2—3.5 mm, densely ferruginously pilose, anthers compressedly oblong-ovoid, 3.5—4 mm long, apex bifid, with a few ferruginous hairs on the back, dehiscing extrorsely. *Ovary* ovoid, c. 1.5 by 2 mm, 6-celled, with a few ferruginous hairs, at base surrounded by an up to 1 mm high disk. *Style* filiform, c. 1.5 cm long, glabrous, articulate shortly above ovary and differently coloured there. *Fruits* subglobose, up to 3.2 by 2.3 by 1.9 cm, 1-seeded, rounded, pericarp thin, woody, glabrous. Seeds incompletely known, scar covering at least $\frac{1}{4}$ of the surface of the seed.

Type specimen: *Thwaites 3012* in K.

Distribution: Ceylon.

CEYLON. Ambagamowa distr., Hinidoon & Reigam Corles: *Thwaites 3012* (A, BO, CAL, G, K, L, US), fl. & fr.

42. *P. dasyphyllum* (de Vriese) Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 8; Lam, l.c. 1925, 73; Lam, l.c. 1927, 405 — *Isonandra dasyphylla* de Vriese, Nat. Tijdschr. Ned. Ind. 21, 1860, 307; de Vriese, J. bot. néerl. 1, 1861, 256; Beauvisage, Contr. Etude Org. bot.

Gutta-Percha, 1881, 34 — *Palaquium stenophyllum* H. J. Lam, l. c. 1925, 97, f. 28; Lam, l. c. 1927, 411; Merrill, Pl. Elm. Born. 1929, 238.

Trees, c. 25 m. Branchlets slender, 2—4 mm in diam., ferruginously or reddish tomentose or woolly, as are the terminal cone and stipules, pubescence persisting rather long, finally branchlets glabrous; terminal cone up to 12 mm long; stipules linear-lanceolate, up to 9 by 2 mm large, apex acute, sometimes dorsally crested, tomentose on either side, persisting rather long, finally caducous. *Leaves* scattered, obovate, oblong or elliptic, 12—21 by 5—9 cm, apex obtuse or rounded and obtusely acuminate, acumen up to 10 mm long, base cuneate to subrotundate, rarely rounded, shortly decurrent along adaxial side of petiole, glabrous on either side except sometimes the basal part of upper side of midrib and brownish or ferruginously woolly-tomentose on the lower side of the midrib, and sometimes of the nerves, chartaceous to subcoriaceous; midrib grooved above, prominent and rounded below, secondary nerves 7—12 pairs, ascending at an angle of 45°—70°, slightly curved but usually straight and curved at their tips only, diminishing until inconspicuous near the margin, prominulous and grooved above, prominent below, tertiary nerves very slender, transverse, inconspicuous on either side but sometimes more distinct below than above. Petioles (6—)10—20 mm long, usually flat above, sometimes slightly grooved in the apical part only, brownish or ferruginously woolly-tomentose, sometimes partly glabrescent. *Flowers* in 5—11-flowered, axillary clusters, pedicels angular, 8—16 mm long, brownish or ferruginously woolly-hirsute or tomentose. *Sepals* ovate-oblong to lanceolate-linear, 3—4 by 1.5—2 mm, apex acute or obtuse, ferruginously or brownish woolly-tomentose on outside and glabrous on inside, sometimes sparsely whitish or ferruginously sericeous at base of inside, with a plumule of darker coloured hairs at the tips, inner sepals with glabrous, membranous margins. *Corolla* 6—13 mm long, glabrous except for the outside of the tube which is ferruginously sericeous, lobes ovate-oblong to lanceolate, 4.5—10.5 by 1.5—2 mm, apex rounded. *Stamens* (9—)12, 3—6 mm long, filaments linear, 1—3 mm long, glabrous, anthers oblong, 3—4 mm long, longly acuminate or bifid, dehiscing extrorsely to laterally, ferruginously sericeous. *Ovary* ovoid, 1.5—2.5 by 1.5—2.5 mm, 6-celled, 12-lobed, yellowish appressedly villose. Style filiform, 6-ribbed, 10—15 mm long, gradually passing into the ovary, glabrous except for the basal part which bears the same pubescence as the ovary. *Fruits* ovoid, or obovoid to ellipsoid, 12—28 by 10—15 mm, 1-seeded, apex rounded, usually with a short remnant of the style, pericarp fleshy, thick, scattered yellowish sericeous, ultimately glabrous(?). Seeds fusiform, c. 10 by 4 by 4 mm, testa thin, black, dull, scar covering half of the seed, light brown, dull. Embryo exalbuminous, radicle punctiform, slightly exsert.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Borneo: beitis, margetahan, njato batu, njatuh kelintjir.

Ecology: Growing in primary forests on lime-stone containing soils or rocks in the lower regions.

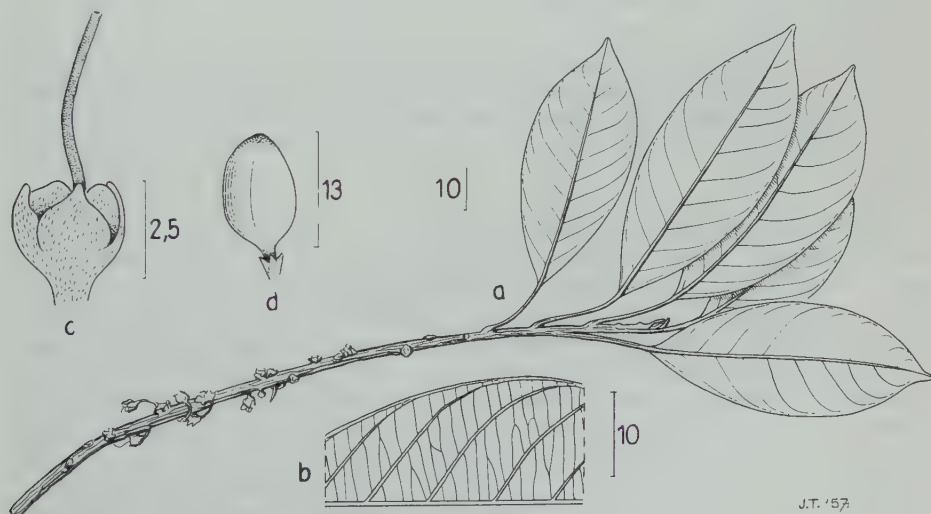
Distribution: Riouw, Borneo.

BORNEO. Sandakan, Elphinstone prov., Tawao, *Elmer 21170* (G, L, NY, S, SING); ibidem: *Elmer 21620* (L, NY, SING); Bettotan, logged area: *Orolo 2870*

(K, L, SAN), tree 16 m, ff. Febr. — Sarawak, Rejang: *Haviland* 508 (K), fl. — Indonesian W. Borneo, Sekadan Pait, alt. 25 m: *NIFS* bb 8045 (BO, L), March. — S.E. Borneo, subdistr. Balikpapan, Sungei Wain, alt. 50 m, primary forest: *NIFS* bb 34261 (BO, L), tree 25 m, Aug.; Loa Haur, west of Samarinda, low ridge, alt. 40 m: *Kostermans* 6798 (BO, L), tree 10 m, fr. green, May; ibidem: *Kostermans* 6823 (BO, L), tree 20 m, fr. green, May; ibidem: *Kostermans* 6955 (BO, L), tree 15 m, fr. May; Loa Djanan, west of Samarinda, ridge, alt. 30 m: *Kostermans* 6624 (BO, L), tree 20 m, fr. April; Berau Betemu air, alt. 50 m: *NIFS* bb 19150 (BO, L), June; ibidem: *NIFS* bb 19113 (BO, L), June; Bandjermasin: *Teysmann* s.n. (BO, L); Martapura: *NIFS* bb 2486 (BO, L), fl. Aug. (type specimen of *P. stenophyllum* H. J. Lam); Pulu Laut, northeast of Stagen, alt. 100 m: *van Slooten* 2271 (BO, L), fl. Nov.; P. Laut, Sei Paring, alt. 100 m: *NIFS* bb 13210 (BO, L), fr. Dec.; ibidem, Seblimbingan: *NIFS* bb 31195 (BO, L, SING), fl. Sept.; Pleihari, Ketapang, alt. 400 m: *NIFS* bb 13755 (BO, L), fl. Sept.; Mt Pamatton: *Korthals* s.n. (L), fl.; P. Lampe: *Korthals* s.n. (L), fr.; Numukan Isl.: *Kostermans* 10827 & 10828 (BO, L), tree, Dec. — Indonesian E. Borneo, E. Kutei, Mt Tepian Lobang, alt. 150 m: *Kostermans* 5410 (BO, L), tree 25 m, fr. green June; Sungei Wain region, north of Balikpapan, alt. 20 m: *Kostermans* 4271 (BO, L), tree 12 m, fr. Aug.; Bengalon Rapah: *NIFS* bb 15323 (BO, L), April; ibidem: *NIFS* 15290 (BO, L), April.

Riouw. Bintang: *de Vriese* s.n. (BO, L), fl.

43. *P. edenii* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 22; Lam, l. c. 1925, 50; Lam, l. c. 1927, 398 — Fig. 7.



J.T. '57

Fig. 7. *P. edenii*, a. branchlet with leaves and flowers; b. tertiary nerves of leaf; c. calyx and gynaecium; d. fruit (*Beccari* 361).

Trees? Branchlets terete, 2.5–4 mm in diam., ferruginously pubescent, glabrescent; terminal cone 5–8 mm long, ferruginously pubescent; stipules lanceolate, 2–3 mm long, apex obtuse, ferruginously pubescent on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, elliptic, 7–10 by 2.2–3.5 cm, short obtusely acuminate, acumen 2–4 mm long, base cuneate, subabruptly narrowed, shortly decurrent along upper side of petiole, glabrous above, sparsely ferruginously tomentose below, mainly so on and along the midrib, thin-coriaceous; midrib grooved above.

prominent and rounded below, secondary nerves 9 or 10 pairs, ascending at an angle of 40° — 45° , slightly curved, grooved above, prominent below, tertiary nerves transverse, few, inconspicuous above, more distinct below. Petioles 15—25 mm long, narrowly grooved above, rounded below, greyish and ferruginously tomentose. *Flowers* solitary, or in 2- or 3-flowered clusters, axillary, pedicels angular, 8—12.5 mm long, sparsely ferruginously tomentose. *Sepals* ovate, c. 2 by 2.5 mm, obtusely acuminate at apex, ferruginously tomentose on outside, glabrous on inside, inner sepals in basal part with a membranous, fimbriate margin. *Corolla* 7—10 mm long, glabrous, lobes 6, narrowly elliptic, c. 5 by 2.5 mm, obtuse. *Stamens* 12, c. 8 mm long, filaments filiform, c. 5 mm long, glabrous, anthers oblong-cordate, 1.5—2.5 mm long, apex mucronate, ferruginously villose on either side. *Ovary* ovoid, c. 1.5 by 2 mm, 6-celled, 6-lobed, glabrous, borne on a thin, glabrous disk. Style filiform, 1—1.2 cm long, glabrous. Immature fruit ellipsoid, c. 1.5 by 1 cm, at apex with a short remnant of the style, subattenuate at base, 2-celled, 1-seeded, pericarp fleshy, glabrous. Seeds not seen but according to Pierre: testa coriaceous to subcrustaceous, embryo with copious albumen and thin cotyledons, radicle short.

Type specimen: *Beccari 361* in P.

Distribution: Borneo.

BORNEO. Sarawak: *Beccari 361* (FI, G, P), fl.

Remark. The seeds described by Pierre are most peculiar because they by no means fit into *Palaquium* but rather into *Planchonella*. The 3-merous flowers and the absence of staminodes exclude this species from *Planchonella* and one might wonder what sort of seed has been seen by Pierre.

44. *P. laevifolium* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 8; Lam, l. c. 1925, 107; Lam, l. c. 1927, 414 — *Isonandra laevifolia* Thwaites, Enum., 1864, 177 — *Dichopsis laevifolia* (Thwaites) Benthams & Hooker, Gen. Pl. 2, 1876, 658; Clarke in Hooker f., Fl. Br. Ind. 3, 1882, 541 — *Bassia laevifolia* (Thwaites) Beddome, Fl. Sylv., 1869—1873, 141.

Medium sized tree. Branchlets angular, 1.5—4.5 mm in diam., blackish brown tomentose, glabrescent; terminal cone c. 1.5 mm long, tomentose; stipules lanceolate, c. 1 by 0.5 mm, acute at apex, tomentose on outside, glabrous on inside, soon caducous. *Leaves* scattered, narrowly elliptic or elliptic-obovate, 7—15 by 2—4.5 cm, apex obtusely acuminate, acumen 1—5 mm long, base cuneate; glabrous on either side but sometimes sparsely ferruginously tomentose along midrib, chartaceous; midrib crested above, rounded or angular below, or ribbed in the basal part, secondary nerves slender, 9—13 pairs, ascending at an angle of c. 50° , curved, diminishing until inconspicuous, prominulous above, not prominent at all below but clearly marked, sometimes prominulous, tertiary nerves slender, transverse, prominulous above, hardly or not prominulous below. Petioles 7—11 mm long, crested above, rounded below, sometimes ribbed, dark brown tomentose. *Flowers* in 3- or 4-flowered, axillary clusters, pedicels angular, 4—7 mm long, densely ferruginously tomentose. *Sepals* ovate, 3—4 by 2.5—3 mm, obtuse at apex, ferruginously sericeous-tomentose on outside, glabrous on

inside, inner sepals with membranous and fimbriate margin. *Corolla* 1.5—2 mm long, glabrous, lobes ovate, c. 1 by 0.8 mm, obtuse or rounded at apex. *Stamens* 12, c. 1 mm long, filaments subulate, c. 0.5 mm long, glabrous, anthers oblong, c. 0.5 mm long, truncate at apex, dehiscing introrsely or laterally, when young with a few hairs on inside, but later glabrous. *Ovary* ovoid, c. 1 by 1 mm, 6-celled, ferruginously hirsute. Style conoid, c. 1 mm long, not clearly marked against the ovary. *Fruits* unknown.

Type specimen: *Thwaites* 2832 in K.

Distribution: Ceylon.

CEYLON. Saffragam Distr. and Reigam Corles: *Thwaites* 2832 (CAL, G, K, L), fl.

45. *P. hexandrum* (Griffith) Baillon, *Traité Bot. Méd. Ph.*, 1884, 1500, Add.; Lam, l.c. 1927, 409; Wyatt-Smith, *Research Pamphlet* 4, 1954, 34, fig. — *P. hexandrum* (Griffith) Engler, *Bot. Jahrb.* 12, 1890, 511; Dubard, *Bull. Soc. bot. Fr.* 56, 1909, *Mém.* 16, p. 8; Lam, l.c. 1925, 85, 257, f. 23; Heyne, *Nutt. Pl. Ned. Ind.*, ed. 2, 2, 1927, 1235; Heyne, l.c., ed. 3, 1, 1950, 1235 — *Isonandra hexandra* (Griffith, *Not.* 4, 1851, 292 — ? *Payena griffithii* Kurz, *For. Fl.* 2, 1877, 121; Kurz, *J. As. Soc. Beng.* 46, 2, 1877, 230 — *Dichopsis hexandra* (Griffith) Clarke in Hooker f., *Fl. Br. Ind.* 3, 1882, 543 — *Palaquium pisang* Burek, *Ann. Jard. Bot. Bzg* 5, 1886, 41, p.p. — *P. hexandrum* King & Gamble, *J. As. Soc. Beng.* 74, 2, Extra Nr. 17, 1905, 197, 407; Ridley, *Fl. Mal. Pen.* 2, 1923, 277.

Trees, up to 50 m. Branchlets angular or terete, 2—3.5 mm in diam., finely whitish or ferruginously puberulous, glabrescent; terminal cone up to 10 mm long, puberulous; stipules lanceolate or ovate, up to 2 by 1 mm, acute or acuminate at apex, puberulous on outside, glabrous on inside, caducous, sometimes longer persistent but finally caducous as well. *Leaves* ovate or oblong-ovate, or subobovate, 5—23 by 2.3—9.7 cm, rounded, obtuse or abruptly short obtusely acuminate, acumen to 7 mm long, base usually broadly cuneate, but sometimes narrowly cuneate; glabrous above or sparsely puberulous along midrib, sparsely whitish, ferruginously or brownish puberulous below but soon glabrous, often black or dark brown above when dry, chartaceous or subcoriaceous; midrib grooved above and rarely crested, rounded below, secondary nerves (7—)8—13(—14) pairs, ascending at an angle of 55°—60°, slightly curved but more so at their tips and diminishing until inconspicuous along margin of leaf, prominulous and sometimes grooved above, prominent below, tertiary nerves slender, transverse, prominulous or inconspicuous above, prominent or inconspicuous below. Petioles slender, 8—32 mm long, grooved above, rounded below, sometimes thickened in the basal part, when young finely greyish or ferruginously puberulous, glabrescent. *Flowers* 3—20-flowered, in 1 or 2 axillary clusters, pedicels angular, 4—13 mm long, in fruit up to 22 mm, appressedly whitish, or yellowish, brownish or ferruginously sericeous, but glabrous in fruit. *Sepals* triangular-ovate or deltoid, 1.5—3 by 1.8—3 mm, acute at apex, inner ones rounded at apex, ferruginously puberulous on outside, glabrous on inside, inner sepals membranous on outside, glabrous along margins, fimbriate. *Corolla* 6—7.5 mm long, glabrous, but the tube ferruginously sericeous on outside and in apical part of inside, lobes elliptic-

oblong or lanceolate, 4.5—6 by 1—2 mm, apex truncate, rounded or subacute, sparsely fimbriate along apex but soon glabrous, reflexed in anthesis. *Stamens* 12, 3—4 mm long, filaments subulate, 2—2.5 mm long, densely woolly or glabrous and woolly at base only, anthers broadly ovoid or elliptic-oblong, 2—2.5 mm long, bifid at apex, glabrous or with a few scattered hairs on the back, dehiscing extrorsely. *Ovary* ovoid, c. 0.5 by 1 mm, 6-celled, 6-grooved, glabrous, rarely pubescent at apex. Style slender, 6-grooved, 6.5—12 mm long, glabrous. *Fruits* globose or ovoid, 2—2.7 (—3) by 1.5—2 (—2.4) cm, 1—2-seeded, rounded or acuminate at apex, pericarp fleshy, when dry often 6-grooved, glabrous. Seeds ovoid or laterally compressed and orbicular, 1.5—2.4 (—2.8) by 1.2—1.7 (—1.9) by 0.8—1.2 (—1.5) cm, obtuse at both ends, testa crustaceous, brown, glossy, scar covering about half of the seed, greyish, dull, embryo exalbuminous, radicle inferior, not exsert.

Type specimen: *Griffith 3609* in K.

Use: The wood is easy to handle but is durable for building purposes only when sheltered against atmospheric influences. The latex is sometimes used for falsifying other latex products. The fruits are edible and from the seed a fat for cooking purposes is extracted.

Vernacular names: Malaya: njato jambak, poko jungek, sundik; Sumatra: balam, balam jabut, balam nasi, balam pinang, balam putih, balam putjuk, belam sesudu, balam sudu, balam t̃erung, balam timah, eki-haitu, kaju londir, majang doran, medang balam, njjatuh, papat, tapis; Borneo: nato nasi.

Ecology: This is a rather frequent species of fresh water swamps and lowland forests on peaty and muddy soil near rivers, but is also found in dry forests. Usually found at low altitudes, but is reported up to 100 m.

Distribution: Malaya, Sumatra, Siberut, Simalur, Enggano and Borneo.

Remarks. Contrary to Lam's statement that var. *eriandrum* has a corolla which on the outside except for its base is densely appressedly sericeous-pubescent, only the reverse has been found, the base therefore being pubescent and the rest glabrous. This same detail is found in var. *hexandrum* (= var. *psilandrum* H. J. Lam) contrary to Lam's report when he describes the corolla of that variety as being glabrous on the outside.

As in both varieties too many intermediate stages were found between the forms distinguished by Lam, as well as in the size of leaves, petioles and pedicels, the forms have been dropped here, the two varieties only being maintained therefore.

Var. *hexandrum* — *P. hexandrum* (Griffith) Engler, var. *psilandrum* H. J. Lam, l.c. 1925, 85, forma *minus* H. J. Lam, l.c. 85, f. 23, a—d, f, and forma *majus* H. J. Lam, l.c. 86.

Filaments of stamens glabrous except for a few woolly hairs at their base. Secondary nerves of leaves 7—11 pairs.

Type specimen: *Griffith 3609* in K.

Distribution: Malaya, Sumatra, Borneo (and Siberut?).

MALAYA. Malacca, Nhanguli: *Griffith 3609* (K, L), fl. Jan.; Plantation nursery: *Hamid 38511* and *39889* (KEP), fl. Febr. and fr. May; Bukit Bruang Res.: *Symington 45912* (KEP), fl. Febr.; Kepong, without known loc.: *Anderson 28* (P),

fl.; Singapore, without known loc.: *Ridley 11373* (K, KEP, SING), fl. Aug., type specimen of *P. hexandrum* King & Gamble; without known loc.: *Maingay 984* (K, G, L).

SUMATRA. Asahan, Aek Mutte, alt. 500 m: *Rahmat Si Buea 9348* (L), tree, June/July; Ophir, Lk Gadang, alt. 90 m: *NIFS bb 19486* (BO, L), Oct.

SIBERUT. See below under doubtful specimens.

BORNEO. Sarawak, Setapok For. Res.: *Zarrill 22* (SAR), fr. Febr.; without known loc.: *Hewitt s.n.* (SING), fr. — Indonesian Borneo, Loa Djanan, W. of Samarinda: *Kostermans 6724* (BO, L), tree 40 m, fr. April; Sungei Wain region, N. of Balikpapan: *Kostermans 4262* (BO, L), tree 26 m, fl. & fr. Aug.; Melawi Tjatut, B. Tungkujung, alt. 400 m: *NIFS bb 26431* (BO, L, SING), tree, Nov.; ibidem: *NIFS bb 26860* (BO, L), tree, Febr.; Sg Mentawir near Balikpapan: *Kostermans 9853* (BO, L), tree, Febr.; Sg Susuh (Sangkulirang): *NIFS bb 34706* (BO, L), tree 36 m, fl. June; ibidem: *Kostermans 5509* (BO, L), tree 36 m, fl. & fr. June; ibidem: *Kostermans 5716* (BO, L), tree 35 m, fr. July; Mt Tepian Lobang, Menubar river: *Kostermans 5309* (BO, L), tree 20 m, fl. & fr. June; ibidem: *Kostermans 5292* (BO, L), tree 20 m, fr. June; Sg Kerajaan, N. of Sangkulirang: *Kostermans 5764* (BO, L), tree 40 m, fr. July; Ng Betung, B. Betung kibak: *NIFS bb 31623* (BO, L, SING), Jan.

Var. *eriandrum* H. J. Lam, l. c. 1925, 86 — *P. hexandrum* (Griffith) Engler, var. *eriandrum* H. J. Lam, forma minus H. J. Lam and forma majus H. J. Lam, l. c. 1925, 87, f. 23 e, g, h, k, l.

Filaments of stamens densely woolly. Secondary nerves 11—14 pairs.

Lectotype specimen: *Achmad 1216* in L.

Distribution: Simalur (and Siberut and Enggano?).

SIMALUR, in marshy forest: *Achmad 1216* (BO, L), fl. July, white.

SIBERUT, ENGGANO. See below under doubtful specimens.

Doubtful specimens.

Var. *hexandrum* ?

MALAYA. Kedah, Jemiang Rd, 48 mile stone: *Kiah 35980* (SING), tree 18 m, Sept.; Penang, Western Hill, alt. 1000 m: *Nauen s.n.* (SING), tree, fr. Aug.; Kelantan, Mt Stong: *Symington 37659* (KEP, SING), tree, Oct.; Perak, Parit For. Res.: *Lazim 34307* (KEP), tree 44 m, April; ibidem: *KEP 34208* (KEP), tree 30 m, Dec.; ibidem: *KEP 39559* (KEP), tree with galls, April; ibidem: *KEP 34287*, *34289* (KEP), March; Pahang, Ulu Selangor, Ulu Tranum For. Res.: *KEP 52862* (KEP), tree, 40 m, fl. Febr. — Selangor, Sungei Buloh Res.: *Jaamat 15286* (KEP), tree 13 m, March. — Malacca, K. Pilang, Senaling Inas For. Res.: *KEP 63864* (KEP), tree 30 m, juv. fr., Dec. — Johore, Soga For. Res., sec. forest: *KEP 70176* (KEP), tree 43 m, Jan. — Singapore, Mandai Rd: *Corner 37720* (BO, KEP, SING), tree, fr. Aug.; Bukit Tinjan Laut: *Corner 37076* (SING), tree 50 m, Aug.; Bukit Timah: *Ridley s.n.* (SING), fr. Aug.

SUMATRA. Sum. East Coast, Padang Siantar, alt. 600 m: *NIFS bb 20399* (BO, L), tree 25 m, March. — Tapanuli, Angkola & Siprak, Panobasan Complex, alt. 600 m: *NIFS bb 23206* (A, BO, L, SING), tree, June. — Sum. West Coast, Pajakumbu, Ulu Air, alt. 1000 m: *NIFS SWK/III-24* (BO), tree 25 m, June. — Riau and Dependencies, Indragirian Uplands, Sungai Akar, alt. 50 m: *NIFS bb 28594* (BO, L, SING), tree, July; ibidem, Danau Mengkuang, alt. 60 m: *NIFS bb 27567* (BO, L), tree, April. — Djambi, Muara Pidjuan, alt. 85 m: *NIFS bb 13174* (BO, L), tree 30 m, Dec. — Palembang, Lematang Ilir, Semangus, alt. 75 m: *NIFS bb 31691* (BO, L), tree, April; ibidem: *NIFS bb 32064*, *32265* (BO, L), tree, July; ibidem, alt. 75 m: *NIFS bb 31711* (BO, L, SING), tree, May; Palembang, *Castillo & Valderama 18* (L, US), tree March; Musi Ilir and Kubu distr., Talang Semandai For. Res.: *NIFS bb 18631* (BO), tree 21 m, juv. fr., July; ibidem: *Endert P 535* (BO, L), tree; ibidem: *Endert P 423* (BO, L), tree, juv. fr.

MENTAWI ISLANDS. Siberut, Sibiguana, alt. 40 m: *NIFS bb 17466* (BO, L), tree 28 m, Sept.

BORNEO. Indonesian Borneo, Berouw Batemu Ayer, alt. 5 m: *NIFS bb 19050* (A, BO, L, SING), May; Tanah Bumbu, alt. 25 m: *NIFS bb 13073* (BO), tree 15 m, Dec.; Balikpapan, Sungei Wain: *NIFS bb 34267* (BO, L), tree 26 m, fl. buds; Upper Mahakam, Parei, alt. 300 m: *NIFS bb 20702* (BO, L), tree, Febr.

Var. *eriandrum* ?

MENTAWI ISLANDS. Enggano, near Buabua, alt. 100 m: *Lütjeharms* 4252 (A, BO, L, NY, SING), tree, June. — Siberut, Katorei, alt. 20 m: *NIFS* bb 23368 (BO, L), tree, Oct.

Remark. The specimens mentioned by Lam under the headings "with small leaves" and "with large leaves" probably all belong to the var. *hexandrum* except the specimens from Simalur which belong to the var. *eriandrum*.

46. *P. cryptocariifolium* van Royen, n. sp. — *Palauquium* (*specimen anomale*) *spec.*, Lam, l.c. 1927, 413 — Fig. 8.

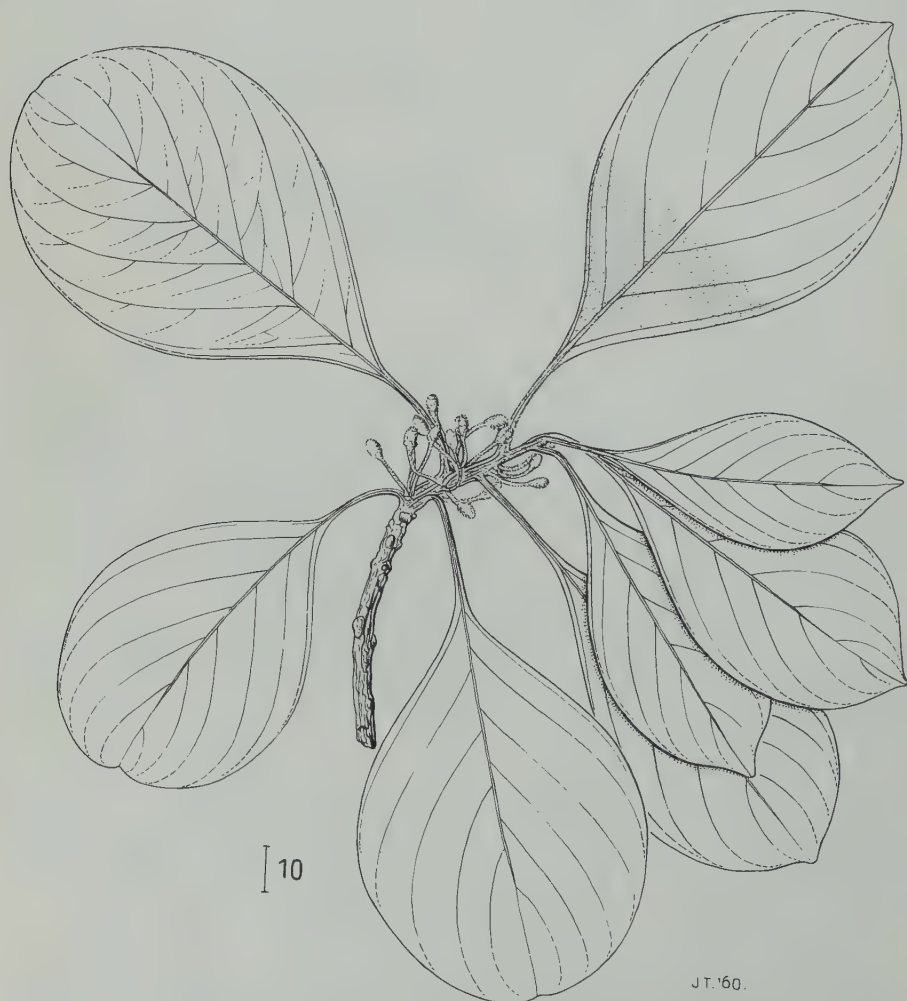


Fig. 8. *P. cryptocariifolium*, habit (Wyatt-Smith 78841).

Arbor magna; inflorescentia pseudoracemosa terminalis, vel flores fasciculati, axillares. Ramuli teretes, purpureo-brunnei. Stipulae ignotae. Folia obovato-elliptica vel elliptica, $8-13 \times 3-6$ cm, obtusa vel indistincte obtuse acuminata; costa supra brunneo-lanata, subtus cum nervis secundariis brunneo-lanata. Nervi secundarii utroque latere 5—10, sursum evanescentes, tertiarii transversi. Petiolus 1.1—2.5 cm longus, brunneo-lanatus. Pedicellus 0.5—0.8 cm longus, pallide brunneo-lanatus. Sepala 6,, 7 vel 8, extus brunneo-lanata, intus glabra. Corolla 6-, 7- vel 8-lobata, in loborum linea mediana extus sparse pilosa, intus glabra. Stamina 12, filamenta glabra; antherae sparse pilosae. Ovarium 6- vel 7-loculare, brunneo-hirsutum; stylus glaber. Fructus ellipsoideus, c. 1×0.7 cm, glaber, 1-spermus; semen incomplete cognitum. Typus: *Forest Service Sarawak 1* in E.

Trees. Branchlets terete, c. 3 mm in diam., purplish brown woolly, pubescence long persistent, terminal bud not seen, replaced by a flowering branch. *Leaves* scattered, obovate-elliptic or elliptic, 8—13 by 3—6 cm, apex obtuse or indistinctly obtusely acuminate, base cuneate; subcoriaceous, brownish woolly above along midrib only, below on midrib and nerves, secondary nerves 5—10 pairs, curved, ascending at an angle of c. 45° , curved, diminishing until inconspicuous near margin, prominent on either side but stronger so below, tertiary nerves transverse, slender, inconspicuous or absent on either side. Petioles 1.1—2.5 cm long, flat above, rounded below, brownish woolly. *Flowers* densely crowded along a terminal up to 6 cm long shoot, pedicels angular, 5—8 mm long, light brown woolly. *Sepals* 6 (sometimes 7 or 8), outer ones narrowly ovate-lanceolate, c. 5 by 2.5 mm, obtuse at apex, brownish woolly on outside, glabrous on inside, inner sepals slightly smaller than the outer ones, margins membranous and glabrous. *Corolla* 6- (sometimes 7- or 8-)lobed, 3.5—4 mm long, lobes ovate-lanceolate, c. 2.5 by 1 mm, with a few hairs on outside in middle-line of lobes, truncate, fimbriate. *Stamens* 12, c. 2 mm long, filaments subulate, c. 1 mm long, glabrous, anthers sagittate, 1—1.5 mm long, acuminate, with few ferruginous hairs, dehiscing extrorsely. *Ovary* conoid, c. 1.5 by 1.5 mm, 6- or 7-celled, densely dark brown hirsute. Style subulate, c. 2.5 mm long, glabrous. *Fruits* ellipsoid, c. 10 by 7 mm, glabrous, 1-seeded, seeds not completely known.

Type specimen: *Forest Service Sarawak 1* in E.

Vernacular names: nyatoh beringin, resak nyatoh.

Distribution: Borneo.

BORNEO. Sarawak, Sungei Semengoh Reserve: *F.S.S. 1* (E), fl. Febr.; ibidem: *Carroll 1166* (SAR), tree 16 m, April; ibidem: *Carroll 205* (SAR), tree, fl. Febr.; ibidem: *Muas 1752* (= *SAE 8168*) (SAR), tree 22 m, Dec.

Remark. As is already remarked by H. J. Lam, this species shows some aberrant flowers. But it is by no means true that this applies to all flowers. Therefore, accepting the most common 3-merous flowers as the normal type, this specimen is regarded as representing a new species of *Palaquium*.

47. *P. pierreii* Burck, Ann. Jard. Bot. Btzig 5, 1886, 31; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 7; Lam, l. c. 1925, 95, f. 27; Lam, l. c. 1927, 410.

Trees. Branchlets slender, terete, 1.5—3 mm in diam., sparsely greyish puberulous, glabrescent; terminal cone conoid, up to 3 mm long, ferruginously tomentose; stipules lanceolate, up to 1.5 by 0.5 mm, acute, tomentose

on outside, glabrous on inside, relatively long persistent but finally caducous. *Leaves* scattered, narrowly elliptic, obovate-elliptic, or oblanceolate, 7—16 by 3—6 cm, obtusely acuminate at apex, acumen up to 7 mm long, base broadly cuneate, decurrent along sides of petiole; glabrous on either side but underside rarely with a few scattered ferruginous hairs, chartaceous; midrib grooved above, prominent below and angular or rounded, secondary nerves slender, 7—10 pairs, ascending at an angle of c. 50°, slightly curved, diminishing until inconspicuous near margin, prominulous above, slender below, tertiary nerves few, slender, transverse, inconspicuous above or not visible at all, inconspicuous below. Petioles 8—15 mm long, narrowly grooved above, rounded or angular below, sparsely greyish or ferruginously puberulous or glabrous. *Flowers* in 2—4-flowered, axillary clusters towards tips of branchlets, pedicels slender, angular, 7—17 mm long, sparsely ferruginously puberulous. *Sepals* ovate, 2—2.5 by 1.5—2 mm, acute at apex, sparsely ferruginously puberulous on outside, glabrous on inside, fimbriate. *Corolla* 8—10 mm long, entirely glabrous, lobes linear-oblong, 6—8 by 1—2 mm, acute at apex, reflexed in anthesis. Stamens 12, 4.5—5.5 mm long, entirely glabrous, filaments filiform, 2.5—3.5 mm long, anthers lanceolate, 2.5—3.5 mm long, mucronate at apex, dehiscing introrsely. *Ovary* conoid, c. 1.5 by 1.5 mm, 6-celled, 6-lobed, ferruginously sericeous, at base with a glabrous, 12-lobed disk. Style filiform, 9—15 mm long, subabruptly widening into ovary, glabrous. *Fruits* not seen but according to Burck and Lam: "ovoid, c. 3 by 1.8—2 cm, obtuse at apex, 1-seeded, pericarp fleshy, ultimately glabrous, slightly puberulous when immature. Seeds ovoid, testa nitidous, relatively thick, scar about $\frac{1}{2}$ of its surface, exalbuminous, radicle exsert".

Type specimen: *van der Horst s.n.* in BO.

Vernacular name: bangkal.

Ecology: In forests at low altitudes.

Distribution: Borneo.

BORENEO. Indonesian Borneo, Perigi Limus, alt. 200: *NIFS bb 7077* (BO, L), tree, Aug.; Sambas: *van der Horst s.n.* (1?) (FI), cult. in Hort. Bog.

48. *P. ridleyi* King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr. 17, 1905, 196; Ridley, Fl. Mal. Pen. 2, 1923, 276; Lam, l. c. 1925, 92, 257, f. 26; Heyne, Nutt. Pl. Ned. Indie, ed. 2, 2, 1927, 1239; Lam, l. c. 1927, 410; Heyne, l. c., ed. 3, 1, 1950, 1239; Wyatt-Smith, Research Pamphlet 4, 1954, 40, fig. — *P. ledermannii* Krause, Engl. Bot. Jahrb. 58, 1923, 552; Lam, Nova Guinea 14, 4, 1932, 552, t. 94 — *P. poilanei* Lecomte, Fl. Gen. Indo-Chine 3, 7, 1930, 900.

Trees, up to 30 m. Branchlets terete or angular, often marked by numerous leaf scars, 2—5 mm in diam., ferruginously or greyish puberulous when young, but soon glabrous; terminal cone up to 5 mm long, puberulous, often replaced by a short flowering branchlet; stipules ovate-lanceolate, 1—2 by 0.5—1 mm, acute or acuminate at apex, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered, subconferted or conferted towards tip of branchlets, obovate or elliptic-obovate, rarely elliptic, in sterile specimens 8—19.5 by 4.5—7.5 cm, in fertile specimens 5—10.5 (—16) by 2.3—5 (—7.5) cm, at apex emarginate, rounded or obtuse, rarely short obtusely acuminate, acumen up to 4 mm long, base abruptly narrowed and

cuneate, tapering along the sides of the petioles; glabrous on either side, coriaceous or chartaceous; midrib slightly impressed above and sometimes crested as well, not strongly prominent below, angular, sometimes slightly rounded, secondary nerves 5—10 pairs, ascending at an angle of c. 45°, curved, diminishing until inconspicuous near margin, grooved above, hardly prominulous below, tertiary nerves transverse, slender, grooved or hardly visible above, slightly stronger developed below, in sterile specimens this nervation often stronger developed. Petioles 1—2.8 cm long, flat above, angular or rounded below, glabrous. *Flowers* in 5—11-flowered, axillary clusters or in clusters along a leafless short, terminal shoot, pedicels slender, filiform, 3—7(—14) mm long, sparsely greyish or ferruginous tomentose. *Sepals* 5 or 6, ovate or triangular, 2—3 by 2—3 mm, acute or subacute at apex, ferruginously or greyish appressedly tomentose on outside, inner sepals more rotundate and on outside pubescent except for the membranous, fimbriate margins, pubescent or glabrous on inside. *Corolla* 3—4 mm long, entirely glabrous, in bud lobes on outside ferruginously sericeous in the middle, lobes 5 or 6, spreading campanulate, ovate or ovate-lanceolate, 2—2.5 mm c. 1 mm, rounded or obtuse at apex. Stamens 10—12, 2.5—3.5 mm long, filaments filiform, S-shaped at apex, 2—2.5 mm long, glabrous, anthers oblong, c. 1 mm long, acute at apex, with scattered long ferruginous hairs, dehiscing extrorsely. Ovary ellipsoid, c. 1.5 by 1 mm, 5- or 6-celled and -lobed, glabrous or ferruginously hirsute, at base with an annular, glabrous disk. Style stout, 5- or 6-grooved, 1.5—2.5 mm long, glabrous. *Fruits* obovoid, 12—14 by c. 7 mm, 1- or 2-seeded, rounded at apex but usually with a short remnant of the style, pericarp thin, fleshy, glabrous. Seeds with the same shape as the fruit, c. 11 by 5 by 4 mm, testa thin, scar narrow, about 2 mm wide, embryo exalbuminous, radicle not exsert.

Type specimen: *Ridley 3591 a* in K.

Vernacular names: Malaya: bitis paya; Sumatra: balam rambai, b. sanginai, b. seminai, b. tĕginai, b. tĕnginan, kepingis, kurut, njatu undus, pitis; Banka: kaju arèng, njatoh bindah, n. bindu; Borneo: bidaru, hintan, jara buko, kaju kong, lamejang, njatoh aendus, n. babi, n. jangkar, n. merah; Celebes: kandole; New Guinea: komhom (Asmat language).

Use: Sometimes used for building purposes.

Ecology: In mixed swamp forests or in peatforests.

Distribution: Indo-China, Malaya, Sumatra to Philippines and New Guinea.

INDO-CHINA. Annam, prov. Nhatrang, Minh Hoa, alt. 1500 m: *Poilane 6486* (P, L, NY), shrub, 3 m, fl., *type specimen of P. poilanei* H. Lec.

MALAYA. Penang, West Hill: *Ridley s.n.* (BM), fl. March — Selangor, Bukit Changgang, Klang: *Nur 33954* (A, S, SING), tree, fl. Oct.; ibidem: *Nur 33958* (A, KEP, S, SING), tree, fl. Oct. — Malacca, Selandar: *Malvius 348* (SING), fl. March; Olar Limpit: *Symington 43677* (KEP), tree, fl. April — Singapore, Kranji: *Ridley 4796* (SING), fl. galls, Febr.; ibidem: *Ridley 3591a* (K), fl.

SUMATRA. Bengkalis, Tamansari: *Berguin 246* (BO, L), fl. Aug. — Palembang, Musi Ilir and Kubu regions, Magsang: *NIFS bb 18657* (BO), tree 22 m, fl. green, fr. greyish, Aug.

BANKA. Lobok Besar: *Kostermans 234, 560, 1123* (BO, L, PNH), tree 18—30 m, fl. Sept.-Oct.; Air Terap: *NIFS bb 26317, 26318, 26319, 26879* (BO, L), fl. Nov.-Dec.

RIOUW. Karimun, Sungei Guntung, alt. 25 m: *NIFS bb 20380* (BO, NY, L, SING), fl. Dec.

PHILIPPINES. Luzon, Tayabas prov., Kagascas: *Oro* 30872 (NY, SING), fl. April; prov. Laguna, Mt Maquilung: *Escritor* 11852 (K), fl. Dec.

BORNEO. Sandakan, Kimanis For. Res.: *Wood SAN* A 4597 (A, KEP, L, MEL, SAN), tree 10 m, fl. Aug.; Ulu Mendalong, SSE of Malaman: *Wood SAN* 16775 (A, BO, K, L, SING), tree 18 m, fr. Sept.; ibidem: *Wood SAN* 16812 (A, BO, K, L, SING), tree 40 m, fr. Oct. — Sarawak, Naman For. Res.: *Anderson* S 680 (L, SAN, SING), fl. Jan.; Sibu, swamps: *Anderson* S 472 (SAR), tree 23 m, fr. Febr.; Pulau Bruit: *Anderson* 7921 (L, SAR), tree 16 m, fl. June; ibidem: *Anderson* 8040 (L, SAR), tree 30 m, fl. May; Binatang, Sg Kelepu: *Anderson* 9013 (L, SAR), tree 13 m, fl. Sept. — Brunei, Buakas For. Res., *Anderson* S 2196 (SING), tree, fl. Febr.; Bukit Belalong area, Temburong, alt. 700 m, leached yellow sandy soil, primary forest: *Ashton BRUN* 416 (L), tree 13 m, fl. buds, Sept. — Indonesian Borneo, SE district, Hayup: *Winkler* 3489 (L), fl. June; Sampit: *Buwalda* 7757 (BO, L, SING), tree, juv. fr. Sept.; ibidem: *NIFS* bb 10706 (BO, L), fl. Dec.; W. Kutei, Mujup, alt. 30 m: *NIFS* bb 16803 (BO, L), fr. April.

CELEBES. Mahili, near Usu, alt. 200 m: *NIFS* Cel./II-372 (BO, L), tree 30 m, fl. June; ibidem: *NIFS* Cel./II-99 (BO), tree 25 m; ibidem: *Cel./II-297* (BO), tree; ibidem: *NIFS* Cel./II-298 (BO), tree; ibidem: *NIFS* Cel./II-299 (BO), tree 20 m; ibidem: *Cel./II-372* (BO), tree 25 m.

NEW GUINEA. Western New Guinea, distr. Geelvink Bay, Japen Isl., Seroei, alt. 50 m: *NIFS* bb 30667, 30733 (A, BO, L, SING), fl. Sept.; ibidem: *NIFS* bb 30873, 30883, 30905 (A, BO, L), fl. Sept.; ibidem: *NIFS* bb 30636, 30641 (BO, L), fl. Sept.; without known loc.: *Aet & Idjan* 872 & 910 (BO, L, SING), fl. Sept.

The following sterile specimens might also belong to this species, but the close resemblance to e.g. *P. pseudorostratum* and *P. pseudocuneatum* makes a proper identification almost impossible:

MALAYA. Selangor, Telok For. Res., Kuala Langat: *Wazir* 53902 (KEP), tree 23 m, April; ibidem: *Symington* 45810 (KEP), tree, Jan. — Malacca, Telok F. R.: *Wyatt-Smith* s.n. (KEP), Jan. — Johore, Pengkalen Raja, Pontian: *Ngadiman* SF 36699 (BO, SING), fl. galls, July; ibidem: *KEP* 10258 (KEP), tree 30 m, Dec.; Kualah Pilah, Senaling Ilas For. Res.: *KEP* 63856 (KEP), tree 26 m, Nov.

SUMATRA. Djambi, Muara Pidjuan, alt. 85 m: *NIFS* bb 13183 (BO, L), Dec.; without known loc.: *NIFS* bb 12291 (BO), tree 30 m, Nov. — East Coast, Selatpandjang, Tj Rumbia, P. Padang, alt. 5 m: *NIFS* bb 21289 (BO, L), June; Tg Sei Lakar: *NIFS* bb 12849 (BO), tree 21 m, Oct. — Bengkalis, Serapung Isl., Serapung: *NIFS* bb 12493 (BO), tree 18 m, June — Indragiri Uplands, Gelang Isl., alt. 4 m: *NIFS* bb 29163 (BO, L, SING), Sept.; ibidem, Danau Mangkoang, primary forest: *Buwalda* 6610 (BO, L), April, fl. galls; ibidem: *NIFS* bb 27549 (BO, L), April; ibidem, Simpang: *NIFS* bb 22279 (BO, L), March; Kariah Mawah: *NIFS* bb 13843 (BO, L), tree 20 m, Nov.

LINGGA, without known loc.: *NIFS* bb RI/I-55 (BO), Febr.

BANGKA. Lobok Besar: *Kostermans* 89 (BO), tree 28 m, Sept.; Rias: *NIFS* bb 15411 (BO), tree 18 m, June.

BORNEO. Brunei, Badas swamps: *Anderson* 2827 (SAN), tree, June — Sarawak, Sibu: *SAN* S 872, 874 (SAN), tree 23 m, Febr.; ibidem: *SAN* S 680 (SAN), tree 15 m, Jan.; Loba Kabang South P. F.: *Anderson* S 441 (L, SAN), tree, March; ibidem: *Anderson* S 2619 (SAN), tree; Sg Kelepu, Pulau Bruit: *Morshidi* S 801 (SAN), tree, Febr.; Kawang: *Mail* 6271 (K, L, SAN), tree 5 m, Sept.; Sg Tissak, Tuso, low swamp forest: *Anderson* S 2345 (SING), tree, Nov.; Tg Kigong: *Anderson* 56 (KEP, SAN), tree, fl. July; Setapok For. Res., swampy land: *Egon* 373 (= F 335) (SAR), tree 20 m, fl. (galls!) May; Temburong distr., Kuala Belalong: *SAN* 77076 (A, BO, BRI, K, KEP, L, SING), tree 35 m, March — Indonesian Borneo, Lower Dajak river, Tuanan: *NIFS* bb 9450 (BO, L), Oct.; W. Kutai, Mujup, alt. 20 m: *NIFS* bb 16779 (BO, L), April; ibidem, Kemkang: *NIFS* bb 15632 (BO, L), Sept.; Tdg Bangko Sangasanga region near Samarinda: *Kostermans* 7712 (BO, L), tree 15 m, Aug.; Pontianak, Suka Lanting: *NIFS* bb 12619 (BO, L), tree 22 m, June.

CELEBES. Manado, Banggai, Pongian: *NIFS* bb 31873 (BO, L), tree, March; Kolonodale, Tambajali, alt. 20 m: *NIFS* bb 31509 (BO, L, SING), Jan.; Kolaka, Neha, alt. 25 m: *NIFS* bb 31672, 31822, 31917 (BO, L, SING), May; ibidem, alt. 50 m: *NIFS* bb 32544 (BO, L, SING), tree 25 m, fl. Febr.

SULA ISLANDS. Mangoli, Wai Tamila, alt. 250 m: *NIFS* bb 29919 (BO, L, SING), Sept.

NEW GUINEA. Western New Guinea, distr. Geelvink Bay, Japen Island, Seroei, alt. 50 m: *NIFS* bb 30795, 30834, 30347, 30785, 30637, 30718 (BO, L, SING), Aug.-Sept.; ibidem, Seroei, Mariattoe, alt. 500 m: *NIFS* bb 30478 (A, BO, L, SING), Aug.; ibidem: *NIFS* bb 30373 (BO, L), tree, Aug.; Seroei, alt. 800 m: *NIFS* bb 30356 & 30332 (BO, L), Aug.; Genofa, alt. 450 m: *NIFS* bb 22575 (BO, L), April; distr. Hollandia, Hollandia: *Kalkman NGBW* 3752 & 6222 (L), tree, fl. fr. Oct. — Southern New Guinea, Asmat distr., Erma: *Nautje NGBW* 6551 (L), tree 15 m — Southeastern New Guinea, Fly river: *Brass* 6589 (A, L), fl. May.

Remarks: This species is remarkably variable in the pubescence of the inside of the calyx and of the ovary. In the type specimen and many specimens from the Malay Peninsula, Sumatra and Borneo both are pubescent. In Indo-China, however, a specimen is found with a glabrous ovary and the inside of the sepals also glabrous. This specimen has been described as *Palaquium poilanei* by Lecomte. In New Guinea specimens are found also with a glabrous ovary and a glabrous inside of the calyx but the leaves show a clear transverse tertiary nervation, whereas in the specimen of Indo-China these are entirely absent. The New Guinean specimens could be referred to *Palaquium ledermannii* Krause provided that the latter had been maintained. In Celebes one specimen was found (*NIFS* Cel. II-372) in which the ovary is pubescent and the inside of the calyx glabrous. With these variations in mind it seems irrelevant to maintain *P. poilanei* H. Lec. and *P. ledermannii* Krause as separate species and even the reduction to varietal rank only seems not to be warranted, the more so since in *Brass* 6589 from New Guinea the tertiary nervation is absent. The specimens mentioned from Celebes by Lam 1925, p. 91, all referred to *P. multiflorum*, *NIFS* bb 1874, 2317, 2342, 2346, 2348, 2353, 2355, 2377, 2379, 2385, 2391, 2392, 2415, all specimens from distr. Malili, near Larona, belong to the present species. Some specimens from Celebes (*NIFS* 31509, 31672, 31822, 31917, 32544) differ from all other specimens by the 5-merous flowers with slightly longer pedicels.

49. *P. ellipticum* (Dalz.) Baillon, *Traité Bot. Méd. Phan.*, 1884, 1500; Lam, l. c. 1927, 414 — *P. ellipticum* (Dalz.) Engler, *Bot. Jahrb.* 12, 1890, 511; Brandis, *Indian Trees*, 1906, 424; Dubard, *Bull. Soc. bot. Fr.* 56, 1909, *Mém.* 16, p. 20; Gamble, *Fl. Madras* 4, 1921, 764; Lam, l. c. 1925, 107, 258 — *Bassia elliptica* Dalzell in *Hooker's J. of Bot. and Kew Misc.* 3, 1851, 36; Dalzell & Gibbs, *Bombay Fl.*, 1861, 139; Beddome, *Fl. Sylv.*, 1869, t. 43 — *Dichopsis elliptica* Benthams, *Gen. Pl.* 2, 1876, 658; Clarke in *Hooker f., Fl. Br. India* 3, 1882, 542 — *Isonandra acuminata* Drury, *Useful Indian Pl.*, 1858, 260.

Trees, up to 30 m. Branchlets terete, angular, or irregularly terete, 2—5 mm in diam., ferruginously tomentose, glabrescent; terminal cone up to 3 mm long, greyish or ferruginously tomentose; stipules lanceolate, up to 2 by 1 mm, acute, tomentose on outside, glabrous on inside, caducous. Leaves obovate, obovate-oblong, or subelliptic, 8—17.5 by 3.5—7.5 cm, apex obtusely acuminate, acumen up to 7 mm long, cuneate at base, decurrent along sides of petioles; juvenile leaves greyish, yellowish or ferruginously puberulous on either side, mature leaves glabrous on either side, or glabrous above and subglabrous below, subcoriaceous; midrib slightly grooved above,

subangular or rounded below, secondary nerves 10—13 pairs, ascending at an angle of c. 55°, slightly curved, but sometimes straight and curved at their tips only, irregularly archingly joined, prominulous above and sometimes grooved, prominent below, tertiary nerves transverse, few, the reticulate nervation in between the tertiary nerves outnumbering the latter, prominulous above, prominent below. Petioles 1.3—2 cm, flat above, rounded below, puberulous when young, glabrous when mature. *Flowers* one or two in each axil; pedicels angular, 1.5—3 cm, in fruit thickened, cinnamomously tomentose. *Sepals* ovate, 7—8.5 by 5—6.5 mm, apex subobtuse or obtusely acuminate, ferruginously or pale cinnamomously tomentose on outside, densely ferruginously appressedly tomentose on inside, fimbriate, inner sepals usually narrower than the outer ones. *Corolla* 12—14.5 mm long, 5- or 6-lobed, lobes 7—9 by 4.5—5 mm, apex obtuse and fimbriate, otherwise glabrous. *Stamens* 12—18, in 2 whorls, 9—11 mm long, filaments 4.5—5.5 mm long, almost entirely united with each other and the corolla, anther ovoid, 5.5—6.5 mm long, compressed, caudate and fimbriate at apex, appendix spoon-shaped at apex and only slightly shorter than the anthers, ferruginously tomentose-woolly on inside, dehiscent extrorsely. *Ovary* conoid, c. 2 by 1 mm, 6-lobed, ferruginously hairy. Style filiform, 1.5—1.8 cm long, glabrous. *Fruits* oblong or ellipsoid, c. 4 by 1.5 cm, 1-seeded, apex rounded, pericarp cartilaginous-woody, glabrous, except at the base, seeds almond-shaped, c. 3 by 1 by 0.7 cm, acute at either end, testa blackish, dull, thin, scar covering half of the seed, light brown, dull, embryo exalbuminous, radicle acute, shortly exerted.

Type specimen: *Dalzell s.n.* in K.

Vernacular names: India: kat illupe (Tamil), panehoti, pan-chota (Kamala), pala (Malayan).

Ecology: In evergreen forests, at 300—1300 m altitude.

Distribution: Western Ghats from Northern Kanara southwards, common in Wainad, India.

INDIA. Bombay, Canara: *Dalzell s.n.* (K), fl. & fr. Febr.; Madras: *Drew s.n.* (E), fl.; Northern Division: *Cullen s.n.* (E), fl.; Annamalays, Berpadi to Paralui: *Barber 8464* (CAL), tree, fl. & fr. April; Tinnevelly distr., 800 m alt.: *Hooper & Ramaswami 39432* (CAL), tree, fr. Febr.; Monica: *Barber 3894* (CAL), tree, fl. Oct.; Coorg: *Hole 1* (CAL), fl. Febr.; Duilom, alt. 1100 m: *Bourdillon 186* (CAL), tree, fl. April; Travancore, Udumbanshala, 1600 m alt.: *Mecbold 13232* (CAL), juv. fr. Dec.; Malabar: *Hooker f. & Thomson s.n.* (CAL, L), fl.

50. *P. oxleyanum* Pierre, Bull. Soc. Linn. Paris 1, 1885, 498; King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr 17, 1905, 194; Ridley, Fl. Mal. Pen. 2, 1923, 275; Lam, l. c. 1925, 106; Heyne, Nutt. Pl. Ned-Ind., ed. 2, 2, 1927, 1239; Lam, l. c. 1927, 413; Heyne, l. c., ed. 3, 1, 1950, 1239 — *P. pustulatum* (Hemsley) Dunstan, Bull. Imp. Inst. 2, 1904, 14 — *Dichopsis pustulata* Hemsley ex King & Gamble, l. c. 194.

Medium sized to tall trees, up to c. 20 m. Branchlets terete to angular, 3—8 mm in diam., often with numerous scars of leaves, dark brown or ferruginously, sometimes greyish tomentose, glabrescent; terminal cone up to 7 mm, tomentose; stipules lanceolate, often falcate, up to 2 by 1 mm, acute, tomentose on outside, glabrous on inside, caducous. *Leaves* oblong-obovate, obovate or elliptic, 10—23 by (3.5—)5—10.5 cm, abruptly short

obtusely acuminate, sometimes obtuse or rounded, base narrowly cuneate or broadly cuneate and rather abruptly narrowed close to the petiole; glabrous above, ferruginously, dark brown or greyish brown tomentose below, sometimes entirely glabrous, coriaceous; midrib grooved above, prominent and angular below, secondary nerves slender, 9—20 pairs, ascending at an angle of 60°—70°, straight, curved at their tips and archingly joined, prominulous above, prominent below, tertiary nerves transverse but subparallel to secondary nerves, inconspicuous to distinct above, stronger marked below. Petioles 2—3.8 cm long, grooved above at least in the apical third, angular below, slightly thickened in the basal part, greyish, dark brown or ferruginously tomentose. *Flowers* in 3—6-flowered, axillary clusters at apex of branchlets, pedicels angular, 7—11 mm long, ferruginously tomentose, slightly thickened at apex. *Sepals* 6, united at base only, triangular-ovate, c. 4 by 3.5 mm, subacute at apex, ferruginously tomentose on either side but on inside glabrous in the basal part. *Corolla* c. 9 mm long, glabrous, lobes as long as the tube, oblong, obtuse, reflexed when flowering. *Stamens* 12, 3.5—4 mm long, entirely glabrous, filaments filiform, angular, 2.5—3 mm long, anthers oblong, 2—2.5 mm long, acutely acuminate, dehiscing laterally. *Ovary* conoid, c. 1.5 mm in diam., 6-celled, ferruginously tomentose. Style filiform, 8—11 mm long, glabrous except for a few hairs at the base. *Fruits* oblong or globose, or subglobose, 2—2.5 by 1.5—2.5 cm, 1-seeded, pericarp fleshy, densely ferruginously tomentose, seeds subglobose or ellipsoid, 1.6—1.8 by 1.3—1.8 cm, testa crustaceous, dark brown, scar covering half of the seed, greyish, embryo exalbuminous.

Lectotype specimen: *Maingay* 983 in K.

Distribution: Two varieties, both in Malaya.

Var. *oxleyanum*

Branchlets dark brown or ferruginously tomentose, glabrescent. *Leaves* 10—23 by 3.5—10.5 cm, glabrous above, tomentose below; secondary nerves 14—20 pairs. *Fruits* globose.

Lectotype specimen: *Maingay* 983 in K.

Vernacular names: gētah terban, taban putih, taban sutra, gētah taban, guttah sundik, guttah chaier.

Ecology: In primary forests at low altitudes.

Distribution: Malaya.

MALAYA. Perak, Waterfall Hill, alt. 800 m: *Low* 511, 518 (K), large tree, fr. Aug.; ibidem: *Wray* s.n. (SING), fr.; Kuala Langsar: *Curtis* 3631 (K, SING), fr. Dec.; Taiping Hill, alt. 1000 m: *Curtis* 3638 (K, SING), fr. Oct.; Larut Waterfall: *Curtis* 3724 (SING), Dec.; ibidem: *Wray* s.n. (SING); Parit Kinta: *Burn-Murdock* s.n. (SING), May; Maxwell's Hill: *Ridley* 5505 (SING), abnormal form; without known loc.: *Wray* 590 (K), Jan.; ibidem: *Philips* 1, 2, 3, and 4 (SING), April; Selangor, Kuala Lumpur, Weld Hill: *CF* 4940 (SING), fr.; Sungei Rengam Estate: *Curtis* 3763, 3764 (SING), tree, May; Singapore, Little Hill: *Maingay* 983 (K), June; ibidem: *Collins* s.n. (K), June; Surop: *Hodgson* *CF* 9570 (SING), May; Sungei Nenap, Ulu Tembeling: *Craddock* s.n. (SING), dubious specimen; Bukit Timah For. Res.; *Sinclair* *SF* 40036 (L, SING), Oct.; Botanical Garden, Nursery: *Kiah* s.n. (SING), fl. March; ibidem, Old Tamil Lines: *Nur* s.n. (SING), tree 13 m; ibidem: *Sinclair* s.n. (SING), fl. May.

Var. *glabratum* King & Gamble, l. c., 194; Lam, l. c. 1925, 106.

Branchlets greyish tomentose, glabrescent. *Leaves* 14—19 by 4—7.5 cm,

glabrous on either side, rarely ferruginously or brownish tomentose below; secondary nerves 9—11 pairs. *Fruits* oblong.

Lectotype specimen: *Wray 511* in K.

Vernacular names: gētah menjatoh, gētah taban putih.

Ecology: In forests at low altitudes.

Distribution: Malaya and Siam.

MALAYA. Perak, Waterfall Hill: *Wray s.n.* (SING), fr.; ibidem, Larut: *Wray 511* (K, SING); ibidem: *Wray 518* (K, SING), fr.

SIAM. Kopah: *Haniff 3886* (SING), tree c. 20 m, fl. buds, Febr.

51. *Palaquium simun* n. sp. — Fig. 9.

Arbor magna. Ramuli teretes, cinnamomeo-puberuli, glabrescentes; stipulae lineariae, longe acuminatae, caducae. Folia obovato-spathulata, 8—11.5 × 4—5.2 cm, apice rotundata, glabra. Nervi secundarii utroque latere 10—12, tertiarii transversi. Petiolus 0.5—0.8 cm longus, cinnamomeo-puberulus. Pedicellus 0.3—0.7 cm longus, flavido-puberulus. Sepala 6, extus margine loborum glabro excepto ferrugineo-sericea, intus glabra. Stamina 12; filamenta glabra; antherae ferrugineo-tomentosae. Ovarium 6-loculare; stylus glaber. Fructus ignotus. Typus: *L. S. Smith NGF 1295* in L.

Trees, c. 35 m tall. Branchlets terete, 2—5 mm in diam., cinnamomously puberulous, soon glabrous; terminal cone up to 9 mm long, puberulous; stipules linear, up to 8 by 1.5 mm long, long-acuminate, puberulous on outside, glabrous on inside, caducous. *Leaves* subconferted at tip of branchlets, obovate-spathulate, 8—11.5 by 4—5.2 cm, rounded at apex, cuneate at base and tapering along sides of petioles; membranous-chartaceous, glabrous on either side; midrib minutely crested above, subangular below, secondary nerves 10—12 pairs, ascending at an angle of c. 60°, slightly curved, diminishing until inconspicuous near margin, distinct and prominent on either side, tertiary nerves transverse, slender, prominulous but distinct on either side. Petioles 5—8 mm long, flat above, rounded below, cinnamomously puberulous. *Flowers* seen in bud alone, in 3—7-flowered, axillary clusters, pedicels 3—7 mm long, cinnamomously puberulous. *Sepals* ovate-elliptic, 1.5—2 by 1—1.5 mm, rounded at apex, appressedly tomentose on outside, glabrous on inside, inner sepals with glabrous, membranous and ciliate margins. *Corolla* c. 1.5 mm long, ferruginously sericeous on outside except for the marginal part of the lobes, the latter fimbriate at apex, glabrous on inside. *Stamens* 12, c. 1 mm long, filaments subulate, glabrous, anthers lanceolate, ferruginously tomentose on outside, dehiscing extrorsely. *Ovary* ovoid-diseiform, c. 0.5 by 1 mm, ferruginously hirsute; style c. 2 mm long, glabrous. *Fruits* unknown.

Type specimen: *L. S. Smith NGF 1295* in L.

Vernacular name: simun (Upper Waria), perta-perta (Waigani).

Ecology: In forests at low altitudes.

Distribution: New Guinea.

Southeastern New Guinea, Milne Bay, north of Waigana plantation, on ironstone gravel capped ridge in comparatively open forest, alt. 30 m: *L. S. Smith NGF 1295* (BRI, L, LAE), tree 35 m, fl. March; Normanby Isl., Waikaiuna Bay, inland c. ½ mile from coast: *Womersley & Brass NGF 8630* (L, LAE), tree 23 m, fl. April.

Remark. Very closely related to *P. obtusifolium* Burck but differing in the smaller number of secondary nerves, in the pubescence on the outside of the corolla, in the shorter pedicels, and in the smaller leaves.

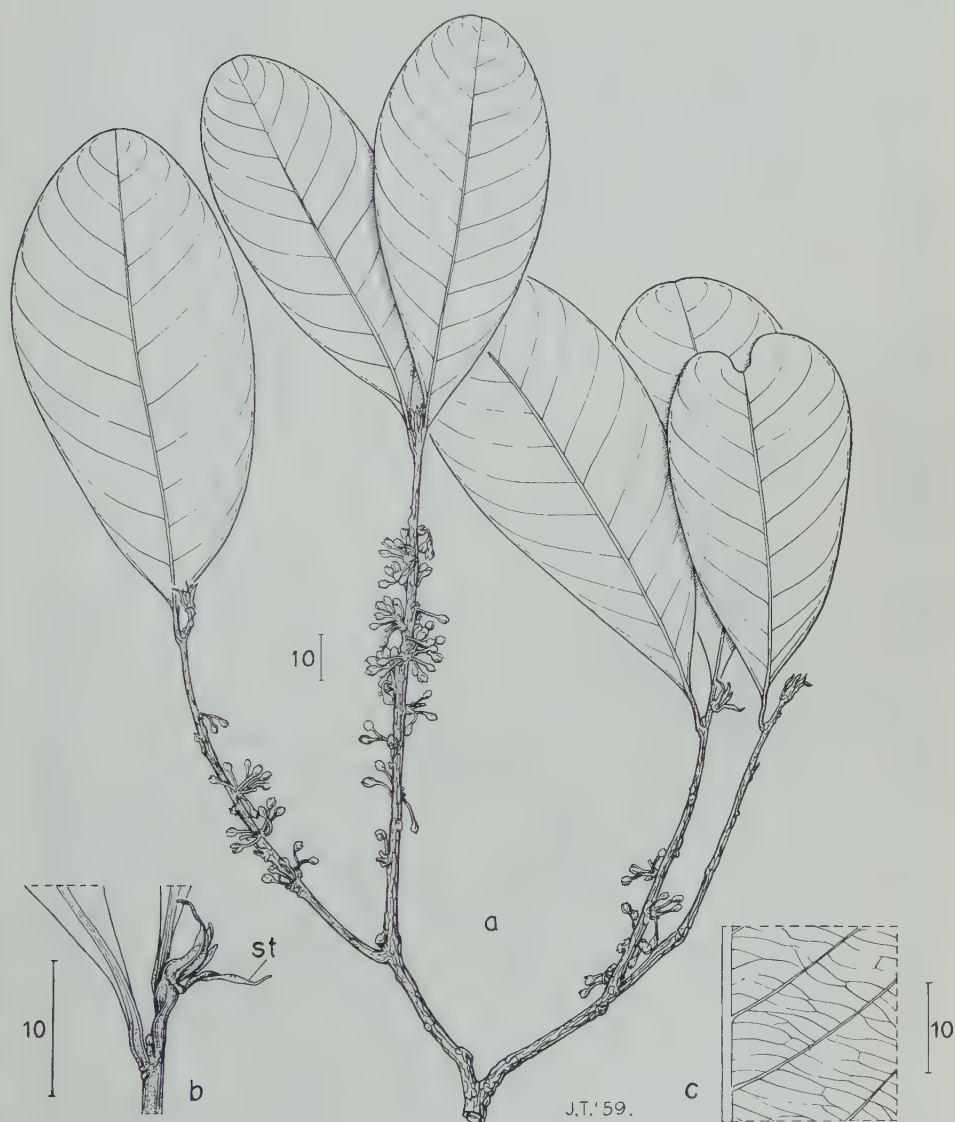


Fig. 9. *P. simun*, a, branchlet with leaves and flowers; b, apical part of branchlet, st, stipule; c, part of leaf with tertiary nervation (L. S. Smith NGF 1295).

52. *P. leiocarpum* Boerlage, Bull. Inst. Bot. Btzg 5, 1900, 24; Lam, l. c. 1925, 27; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1236; Lam, l. c. 1927, 387; Heyne, l. c., ed. 3, 1, 1950, 1223, 1236 — *P. molle* Pierre in Beccari, Nelle For. Borneo, ed. 1, 1902, 559; Lam, l. c. 1925, 105; Lam, l. c. 1927, 413.

Trees, 6—25 m. Branchlets angular to terete, 2—8 mm in diam., greyish or dark ferruginously tomentose, glabrescent, with scattered small warts; terminal cone 2—7 mm long, greyish or ferruginously tomentose; stipules ovate to lanceolate, up to 5 by 2.5 mm, apex acute, greyish or ferruginously tomentose on outside, glabrous on inside, caducous. *Leaves* usually scattered, sometimes subconferted, broadly ovate, suboblong, elliptic or obovate, (5—)8—20(—27) by (4—)5—8(—10) cm, apex rounded, shortly and bluntly or acutely acuminate, or long and acutely acuminate, acumen up to 1 cm long, base cuneate, usually abruptly narrowed, shortly decurrent along adaxial side of petiole; glabrous above, dark or light brown, or dark or light reddish ferruginously tomentose (rarely sericeous) below, coriaceous; midrib grooved above and minutely crested, prominent and rounded below, secondary nerves (10—)17—20(—22) pairs, ascending at an angle of 50°—65°(—75°), straight and curved at their tips or slightly curved, or S-shaped, diminishing until inconspicuous, rarely archingly joined, inconspicuous above, prominent below, tertiary nerves transverse but almost parallel to the secondary nerves, few and with a transverse reticulate nervation in between, inconspicuous above, prominent below. Petioles 1.5—5.5 cm, minutely grooved in the apical part, slightly thickened in the basal part, with the same type of indumentum as the leaves, ultimately glabrous. *Flowers* in 3—6-flowered clusters, axillary, pedicels 0.8—1.5 cm long, in fruit up to 3 cm long, with the same type of indumentum as of the leaves. *Sepals* triangular-ovate, outer ones 2—3.5 by 2—3 mm, inner ones slightly smaller, apex of outer ones acuminate and obtuse, inner ones subacute to rounded, ferruginously velutinous on outside, glabrous on inside. *Corolla* 7—9 mm long, ferruginously tomentose on outside on tube only, sparsely tomentose in throat on inside, lobes lanceolate-linear, c. 6.5 by 1.5 mm, obtuse, fimbriate. *Stamens* 12, c. 7 mm long, filaments filiform, c. 3.5 mm long, anthers sagittate, c. 4 mm long, long-acuminate at apex, ferruginously sericeous on outside, dehiscent introrsely. *Ovary* ovoid, c. 1 by 1 mm, 6-lobed, 6-celled, ferruginously sericeous. Style filiform, c. 12 mm long, 6-ribbed. *Fruits* globose to ellipsoid, 1.4—2 by 1.2—2.5 cm, often crowned by the style or its rudiment, 1- or 2-seeded, pericarp fleshy or woody, thick, glabrous. Seeds obliquely ellipsoid or subglobose, 6—18 by 4—15 mm, testa cartilaginous, scar covering half of the seed, whitish, dull, embryo exalbuminous, radicle not seen.

Lectotype specimen: *Romburgh 2* in BO.

Use: The latex of this tree is extensively used for the production of rubber. Sometimes it is used for mixing with superior types.

Vernacular names: Sandakan: nyatoh; Sarawak, jangkai, nyatoh jangkar, tangkai; Indonesian Borneo: djongkang (Western Div.), gëtah hangkang (S. and E. Div.); hangkang (all divisions).

Ecology: In primary forests, usually at low altitudes.

Distribution: Borneo, Celebes.

BORNEO. *Brumei*, R. Ingei, primary forest, karangas: *Ashton BRUN 149* (L),

tree 38 m, fl. buds white, July — Sandakan, Sipitang, Mengalong Forest Reserve, c. 14 km SW of Sipitang, alt. 3 m: *Wood & Wyatt-Smith SAN 44665* (A, KEP, L, MEL, SAN, SING), tree c. 25 m, fr. July; ibidem, Ulu Moyah, SSE of Malaman, alt. 900 m: *Wood SAN 16694* (L, SAN), tree 25 m, Sept. — Sarawak, Sungai Semup, rain forest: *Anderson 40* (OXF), Nov.; Baram IV Div.: *Tready S 1239* (SING), Febr.; Batu 6 For. Res.: *Egon 1925 & 1926* (KEP), tree, fl. May; Matang Rd, Kuching: *Omar 359* (SING), fr. Jan.; Kuching: *Beccari 1362* (FL, P), fr. Febr., type specimen of *P. molle* Pierre; Sg Kigong: *Anderson 55* (KEP), fl. July — Indonesian Borneo, without loc.: *Romburgh 2* (BO), fr.; Southern and Eastern Div., Moeara Teweh, Papas, alt. c. 25 m: *NIFS bb 28091* (BO, L, SING), May; ibidem: *NIFS bb 28092* (BO, L), May; ibidem: *NIFS bb 29671* (BO, L, SING), juv. fr. Oct.; ibidem: *NIFS bb 29639* (BO, L, SING), juv. fr. Nov.; ibidem: *NIFS bb 21259* (BO), tree 19 m, June; Poeroek Tjahoe, Tb. Djolor, alt. 250 m: *NIFS bb 21219* (BO, L), *bb 21220* (BO), July; Boemtok Riam Batoe, alt. 20 m: *NIFS bb 21265* (BO, L), June; Lower Dajak river, Danau Rawak: *NIFS bb 13475* (BO), tree 18 m, Nov. CELEBES. Malili, Larona: *NIFS bb 2363* (BO, L).

53. *P. obtusifolium* Burek, Ann. Jard. bot. Btzg 5, 1886, 33; Koorders, Med. 's Lands Plantentuin 19, 1898, 519; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 20; Lam, l. c. 1925, 100; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1239; Lam, l. c. 1927, 411; Heyne, l. c., ed. 3, 1, 1950, 1239 — *P. negrosense* Merrill, Phil. J. Sc. 10, 1915, 63; Dubard, Bull. Mus. hist. nat. 15, 1909, 381 (*sub P. obovatum* ? Engler); Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 281; Lam, l. c. 1925, 99; Lam, l. c. 1927, 411 — *P. ternatense* H. J. Lam, l. c. 1925, 103, f. 30; Heyne, l. c. 1241 in both ed. 2 and 3.

Trees, up to 45 m. Branchlets subterete, 2–6 mm in diam., with a variously coloured pubescence, glabrescent; terminal cone up to 8 mm long, pubescent in the same colours as the branchlets; stipules lanceolate or ovate-lanceolate, up to 8 by 2 mm, apex acute, pubescent on outside but often along the margins glabrous, the latter fimbriate, inside glabrous, semi-permanent or caducous. *Leaves* scattered to subconferted at apex of branchlets, spathulate, obovate, obovate-oblong or elliptic, (10–)14–26(–30) by (4–)7–9.3(–12) cm, apex usually subacute but sometimes emarginate, rounded, obtuse, obtusely or acutely acuminate, acumens up to 5 mm long, base narrowly cuneate to rounded or truncate, decurrent along sides of petioles; glabrous above, sparsely pubescent below when young but soon glabrous, thinly coriaceous; midrib grooved above and sometimes crested as well, prominent and angular below, secondary nerves 10–17 pairs, ascending at an angle of 45°–60°, but in the basal part up to 90°, straight but curved at their tips and diminishing until inconspicuous near margin of leaf, grooved above, prominent below, tertiary nerves very slender, transverse, sometimes rather inconspicuous on either side. Petioles 7–18(–25) mm long, flat above, finely whitish, greyish or ferruginously pubescent but ultimately glabrous. *Flowers* in 2–5-flowered, axillary clusters, sometimes at apex of up to 2 mm long brachyblasts, pedicels angular, 9–15(–32) mm, ferruginously or cinnamonously brown sericeous. *Sepals* broadly ovate to subrotundate, 3–3.5 by 2.5–3.5 mm, sericeous on outside, glabrous on inside, apex of outer sepals subacute, the inner sepals rounded and with glabrous margins. *Corolla* 6–8 mm long, glabrous except on outside sometimes with a few ferruginous hairs in the middle-line of the lobes, and always with a few hairs in the throat, lobes reflexed in anthesis, ovate-oblong 5–7.5 by 2–3 mm, apex truncate. *Stamens* (12–)18, 4–5.5 mm

long, filaments filiform, 2.5—3.5 mm, glabrous, anthers ovoid-oblong, 2.5—3.5 mm long, apex mucronate, sometimes bifid, sparsely ferruginously hairy. *Ovary* conoid, c. 1.5 by 2.5 mm, 12-lobed, 6-celled, minutely yellowish tomentose. *Style* filiform, 10—15 mm long, glabrous. *Fruits* ovoid or obovoid, sometimes oblique, 3—4 by 2—2.5 cm, acute at apex and usually bearing a remnant of the style, 1-seeded, pericarp thin-fleshy, glabrous. Seeds slightly smaller than the fruit, fusiform, 2.5—3.5 by 1.6—2.2 cm, laterally slightly compressed, acute at either end, pale greyish-brown, scar as long as seed, covering a fourth of the total surface, brownish, embryo exalbuminous, radicle inferior, not exsert.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Sumatra: nyatoh balam, n. bunga tandjung; Bali: ngantoh; Flores: wenana; Buton: bokoroeo, tagimanu; Celebes: kumé moputé, k. motaha, natu buja, natog, nantu, tataha-an, tata-an, weloan; Muna: taim anu; Ternate: tofiri modjiu, t. modjiui; Morotai: tehiriki, tewiring; Garat: nato; Philippines: bagoy, nato; Wiageo: naat.

Ecology: In primary forests at low altitudes.

Distribution: Sumatra, (Java, cultivated), Bali, Sumbawa, Philippines, Selayar, Buton, Celebes, Sula Islands, Talaud, Ternate, Buru, Ceram, Morotai, Tanimbar Islands, New Guinea.

SUMATRA. Atjeh, Krung Luas, alt. 25 m: *Asdat* 86 (BO, L), Aug.

JAVA. cult. in Hort. Bog.

BALI. f. Lam 1925.

SUMBAWA. f. Lam 1927.

NEGROS. San Carlot, alt. 200 m, on riverbank: *Tamesis* & *Contreras* 28 (PNH?), tree 18 m, fl.; without known loc.: *Everett* 7325 (PNH?); near San Carlos: *Tamesis* 20696 (L), juv. fr., Sept., type specimen of *P. negrosense* Merrill.

MINDANAO. f. Merrill 1923, 281.

SELAYAR. Labuan Marege, Djampea Isl., alt. 270 m: *NIFS* bb 22958 (BO, L, SING), Aug.

BUTON. f. Lam 1925.

SULA ISL. Samana, Upper Wai Towata river, alt. 100 m: *NIFS* bb 28826 (BO, L, SING), fl. Aug. — Mangoli, north of Wai Tamila, alt. 100 m: *NIFS* bb 29912 (BO, L, SING), fl. Oct.; ibidem: *NIFS* bb 29756 (BO, L, SING), fl. Aug.

CELEBES. Menado, Poso, Kalora, alt. 15 m: *NIFS* bb 28732 (BO, L, SING), fl. Aug.; Banduga, alt. 5 m: *NIFS* bb 31905 (BO, L), fl. March; ibidem: *NIFS* bb 31843 (BO, L, SING), Febr.; Mawuroto, Tg Kajunjole: *NIFS* bb 31848 (BO, L, SING), Febr.; Kolonedale, Tambajoli: *NIFS* bb 31523 (BO, L, SING), Dec.; Banggai, Sampaka: *NIFS* bb 31836 (BO, L, SING), Nov.; Gorontalo, alt. 200 m: *NIFS* bb 19413 (BO, L), Dec.; Molinggapato: *NIFS* bb 18016 (BO), tree 40 m, fl. buds, Dec.; Boalema, Batumotolohu: *NIFS* bb 13802 (BO), tree 20 m, Sept.; Kwandang, Tititdu: *NIFS* bb 7493 (BO), tree 20 m, Sept.; Bolaänf Mongondow, Solimandungan, alt. 200 m: *NIFS* bb 32481 (BO, L, SING), tree 38 m, fl. yellow, Oct., fr. green; Malili, Usu, alt. 100 m: *NIFS* Cel./II-308 (BO, L, SING), juv. fr., May; ibidem: *NIFS* bb 32606 (BO, L), tree 25 m, March; Pasir Manangui: *NIFS* bb 23261 (BO, L, SING), Sept.; ibidem: *NIFS* Cel./II-280 (BO), tree 30 m, June; ibidem: *NIFS* bb 13576 (BO), tree 23 m, April; ibidem: *NIFS* Cel./II-427 (BO, L), Aug.; Masamba, Patila, alt. 25 m: *NIFS* bb 24505 (BO, L), May; Minahassa: *Teyssmann s.n.* (BO), type specimen of *P. obtusifolium* Burck.

TALAUD. f. Lam 1925.

TERNATE. f. Lam 1925.

BURU. Balo Balo, alt. 50 m: *NIFS* bb 31365 (BO, L, SING), Dec.

CERAM. f. Lam 1925.

MOROTAI. Tobelo. Toto dokoe, alt. 30 m: *NIFS* bb 33814 (A, BO, L, LAE, SING), tree 25 m, juv. fr., May.

TANIMBAR ISL. Lurumbun, alt. 60 m: *NIFS* bb 24428 (BO, L), April.

WAI GEO. Majalibit Bay, eastern shore near Waifo, Bam Creek, in primary forest along creek dominated by *Alstonia* sp.: van Royen 5148 (L), tree c. 45 m, fl. blackish brown, anthers orange, Jan.

NEW GUINEA. Western New Guinea, Geelvink Bay distr., Momi S of Manokwari: Yasutake 22 (BO), Oct.; distr. Hollandia, Holtekang: NGBW 1605 (L), tree 30 m, Oct.

54. *P. burckii* H. J. Lam, l. c. 1925, 57, 255, f. 10; Heyne, Nutt. Pl. Ned.-Ind., ed. 2, 2, 1927, 1232; Lam, l. c. 1927, 399; Heyne, l. c., ed. 3, 1, 1950, 1232 — Fig. 10.

Trees, up to 40 m. Branchlets terete or angular, 3–6 mm in diam., ferruginously tomentose, but ultimately glabrous; terminal cone up to 4 mm long, ferruginously tomentose; stipules lanceolate, up to 3 by 1.5 mm, aristulate or acute at apex, ferruginously tomentose on outside, glabrous on inside, long persistent but ultimately caducous. Leaves scattered, obovate, 8–23 by 4–8.2 cm, apex rounded, sometimes short obtusely acuminate, acumen up to 3 mm, base narrowly cuneate, subobtusate, or subtruncate, decurrent along adaxial side of petiole; dark brown ferruginously tomentose, but mature leaves glabrous above, sometimes along underside of midrib greyish or ferruginously tomentose, thin-coriaceous; midrib grooved above, prominent and angular below, secondary nerves (10–)13–19 pairs, ascending at an angle of 60°–65°, curved or straight and curved at tips only, diminishing until inconspicuous near margin, prominulous above and sometimes grooved, prominent below, tertiary nerves transverse, slender, prominulous on either side but obscured below by the dense pubescence. Petioles 2–4.5 cm, grooved above, ferruginously or greyish tomentose. Flowers in (3–)5–10-flowered, axillary clusters, sometimes in 2 clusters, pedicels angular, (1.5–)3–3.5 cm, patent or bent downwards, ferruginously tomentose, in fruits thickened and up to 4 cm long. Outer sepals broadly ovate, 3–3.5 by 3.5–5 mm, apex rounded, subacuminate, or subacute, ferruginously tomentose on outside, glabrous on inside, but usually one sepal partly tomentose on inside but ultimately becoming also glabrous, inner sepals ovate to elliptic-ovate, slightly longer and narrower than outer ones, apex obtuse to subacute, membranous and glabrous along margin, tomentose on outside, glabrous on inside. Corolla 7–14 mm long, densely ferruginously appressedly tomentose on outside but glabrous along margin and at base of the tube, glabrous on inside, lobes lanceolate, lanceolate-ovate or oblong, 4–6.5 by 2.5–4 mm, apex subacute, obtuse or truncate, sometimes fimbriate. Stamens 20–25, in 2 whorls, 3–5 mm long, filaments subulate, c. 1 mm long, with long ferruginous hairs, anthers oblong-ovoid, compressed, 2.5–4 mm, apex acuminate, dehiscing laterally, glabrous. Ovary ovoid, c. 1.5 by 2 mm, 6-lobed, 6-celled, ferruginously tomentose. Style filiform, 9–17 mm long, grooved, glabrous. Fruits ovoid-ellipsoid, 4.3–7.5 by 2–3 cm, 1-seeded, apex subacuminate, acuminate or acute, pericarp thin, fleshy, ferruginously tomentose, endocarp woody, thin. Seeds the same shape as fruit, slightly smaller, acute at either end, light brown, scar covering half of the seed, pale brown; embryo exalbuminous, radicle small, not or hardly exsert.

Lectotype specimen: *Beguin 486* in L.

Vernacular names: suntei; Sumatra: suntei hitam; siak illipe nuts, English.



Ecology: In marshy or peat-forests at low altitudes.

Distribution: Malaya, Sumatra, Riouw Islands.

MALAYA. Johore, Pangkalan Raja, Pontian: *Ngadiman SF 36683* (L, SING), fl. July; Ayer Masin Malay Res.: *KEP 75602* (KEP), tree, Oct.

SUMATRA. Sumatra East Coast, Asahan: *NIFS bb 33098* (BO, L), tree, fr. Nov.; Labuan Batu, Serdang, alt. 5 m: *NIFS bb 33093* (BO, L), Oct. — Indragiri, Sg Gareng, peat-forest: *Polak 530* (BO, L), Sept. — Bengkalis, Rangsang Island: *Beguin 486* (BO, L), fr. Nov.; Sebank, marshy forest: *Beguin 423* (BO, L), tree 28 m, fl.; Mendal Island: *NIFS bb 12474* (BO, L), tree, fl. May; Rantauapandjang: *NIFS bb 24441* & *24444* (BO, L, SING), tree 36 m, fl. May; Sg Kembung, alt. 1 m: *NIFS bb 17364* (BO, L), tree, fl. April; ibidem: *NIFS bb 17365* (BO, L), tree, fl. May; Kempastinggi: *NIFS bb 24447* (BO, L), tree, fl. June; Kelapapati: *NIFS bb 25561* (BO, L), tree, Sept.; ibidem: *NIFS bb 26507—26522* (BO), tree 34—38 m, Oct.; ibidem: *NIFS bb 23120* (BO, L), tree 24 m, Sept.; ibidem: *NIFS bb 23123* (BO, L), tree, Sept.; Sei Sago: *NIFS bb 23115* (BO, L), tree, Sept. — Tapanuli, Sibolga and environments, Barus, Pankalan Tapus: *NIFS bb 28458* (BO, L), Aug. — Indragiri Lowlands, Simpang, alt. 10 m: *NIFS bb 23285, 23286, 23287* (BO, L, SING), tree Sept. — Indragiri Uplands, Pagarumbei, Tjenako river, alt. 8 m: *NIFS bb 25764* (BO, L), Oct.; Keritan, alt. 5 m: *NIFS bb 28708* (BO, L), tree, Aug.

RIUW ISL. Karimun: *NIFS bb 17151* (BO, L), tree, fr. Nov.; ibidem: *NIFS bb 5392* (BO, L), May; Gelang Isl.: *NIFS bb 29102* (BO, K, L, SING), tree, Sept.

Remark. Lam's suggestion that two varieties might be distinguished is not supported by the recent collections as intermediate stages between the more roundish fruits (as reported in *Beguin 423*) and the elongate ellipsoid fruits (as in the type specimen *Beguin 486*) are found.

55. *P. firmum* White, Journ. Arn. Arb. 31, 1950, 106 — Fig. 11.

Tall trees, up to 33 m. Branchlets irregularly terete, 3—5 mm in diam., ferruginously tomentose, but soon glabrous; terminal cone up to 8 mm long, greyish tomentose; stipules linear, up to 5 by 1 mm long, acute, tomentose on outside, fimbriate along margin, glabrous on inside, caducous. *Leaves* conferted at tip of branchlets, obovate, 12—15 by 5.5—8 cm, obtuse at apex, broadly cuneate at base, decurrent along upper side of petiole; glabrous on either side, coriaceous; midrib minutely crested above, prominent and rounded below, secondary nerves 5—8 pairs, ascending at an angle of c. 45°, curved, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves very slender, transverse, hardly visible on either side. Petioles 1.5—3 cm long, crested above, rounded below, greyish puberulous above, brownish puberulous below but partly glabrescent mainly in the apical part. *Flowers* unknown. Pedicel of fruit terete, 2—3 cm long, incrassate at apex, ferruginously puberulous, but partly glabrescent; sepals in fruit broadly ovate, up to 4 by 4 mm, obtuse at apex, ferruginously tomentose on outside, glabrous on inside, inner sepals with glabrous and membranous margins. *Fruits* (immature) ellipsoid, 1.5—2.5 by 1.2—1.5 cm, 1-seeded, rounded at either end, pericarp thin, glabrous, shining. Seeds incompletely known, scar probably covering half the seed.

Fig. 10. *P. burckii*, a. branchlet with leaves and flowerbuds; b. branchlet with leaves and fruit; c. tertiary nervation of leaf; d. flowerbud; e. outer sepal; f. inner sepal; g. corolla-lobe; h. stamens; i. basal part of gynaecium (*NIFS bb 24441*, except b. which is after *Beguin 486*).

Type specimen: *Walker BSIP 246* in BRI.

Ecology: In hill rainforests at low altitudes.

Distribution: Solomons.

GUADALCANAL. Beaufort Bay, Kombau river, hill rainforest: *Walker BSIP 246* (A,BRI, K), tree 33 m, fr. Febr.

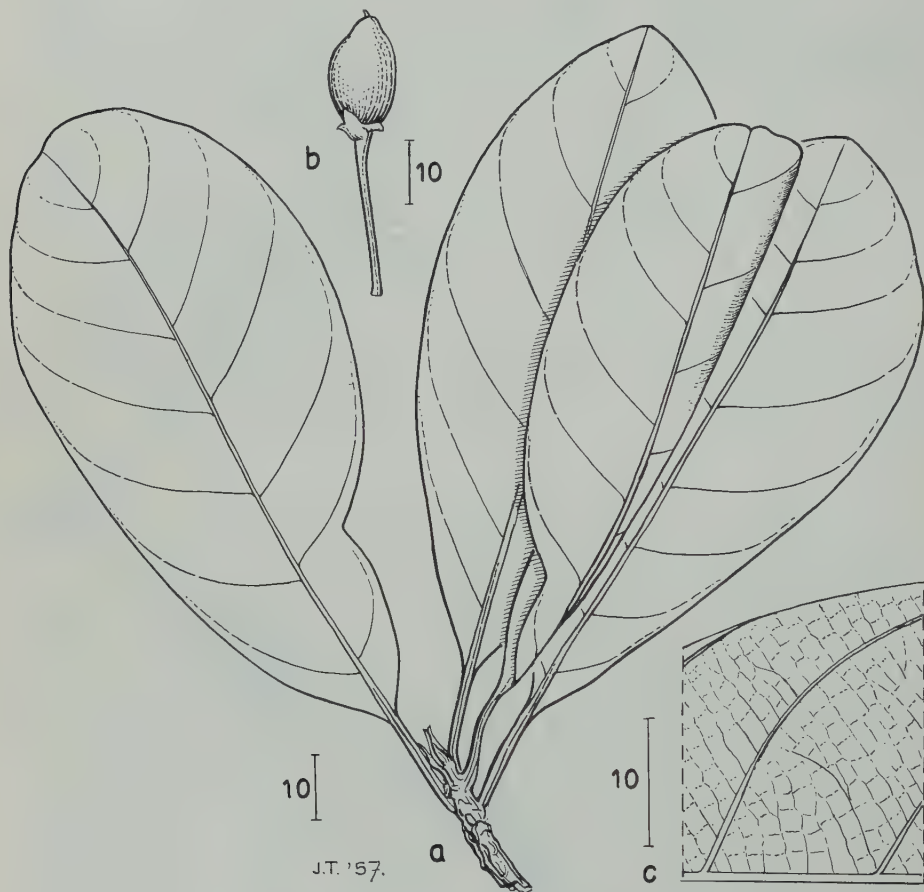


Fig. 11. *P. firmum*, a. branchlet with leaves; b. fruit; c. tertiary venation of leaf (*Walker BSIP 246*).

56. *P. warburgianum* Schlechter, Guttapercha und Kautsch. Exp., 1911, 94, *nomen nudum*; Krause, Bot. Jahrb. 58, 1923, 471, *descr.*; Lam, Nova Guinea 14, 4, 1932, 553, t. 97. — **Fig. 12.**

Trees, 30–40 m. Branchlets stout, terete, 4–10 mm in diam., cinnamonously tomentose, glabrescent; terminal cone up to 12 mm, reddish brown tomentose; stipules linear, up to 3 by 0.5 mm, acute, brownish tomentose, caducous. *Leaves* scattered to subconferted at tip of branchlets, elliptic or subobovate, 14–20 by 6–9 cm, apex indistinctly obtusely

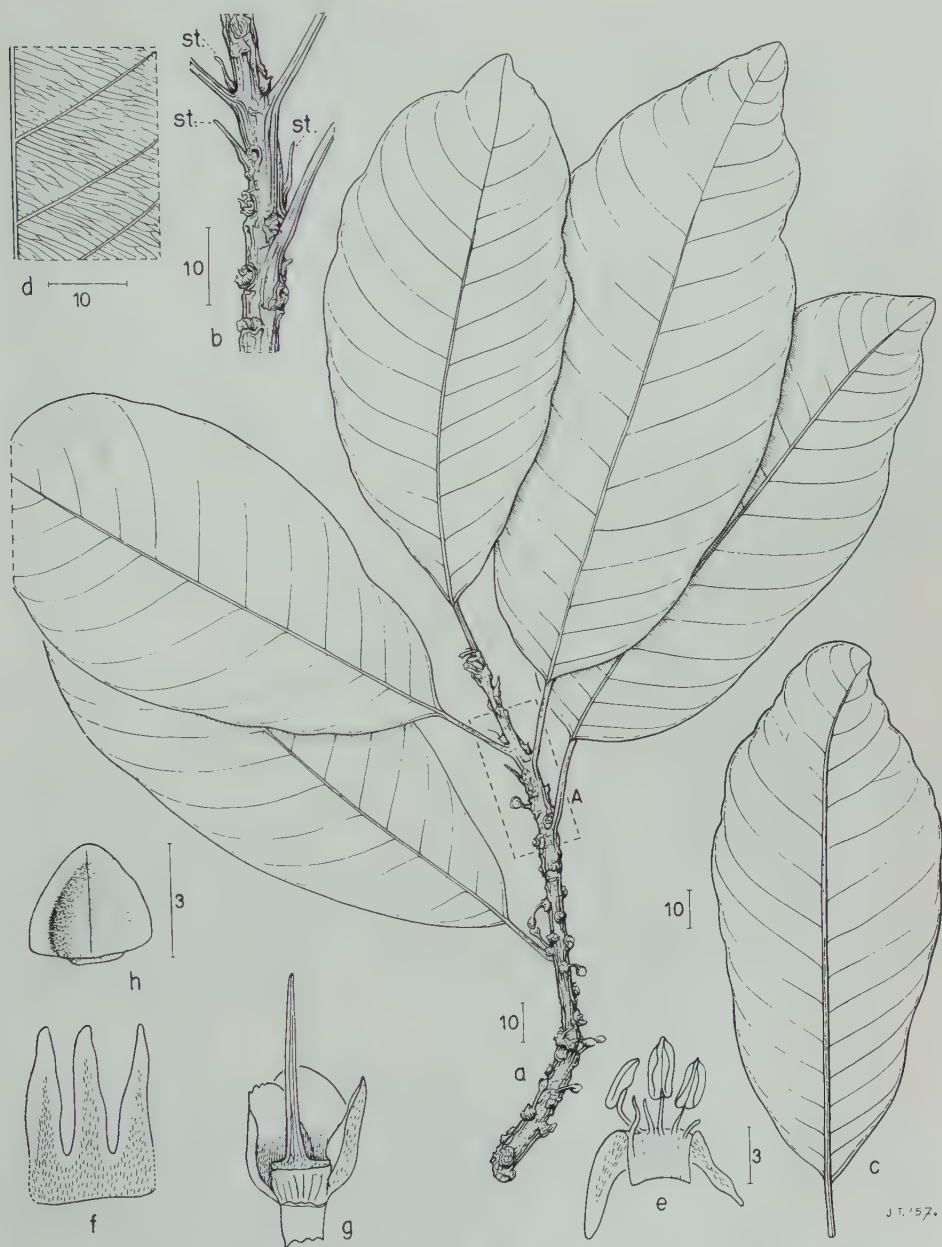


Fig. 12. *P. warburgianum*. a. branchlet with leaves and flowerbuds (part A enlarged in b); b. part of branchlet enlarged (st. stipules); c. leaf; d. tertiary nervation of leaf; e. part of corolla, inside, with a few stamens; f. part of corolla, outside; g. part of calyx, with gynaeceum (a-d. Brass & Versteegh 13543, e-h. Schlechter 16313).

acuminate, base rounded, almost not decurrent along upper side of petiole; glabrous above, cinnamomous or golden-coloured puberulous below, chartaceous; midrib subimpressed above and minutely crested, prominent and rounded below, secondary nerves 14—16 pairs, ascending at an angle of 50°—70°, apical nerves curved, the others straight and curved at tip only, diminishing until inconspicuous, distinct but prominulous above, prominent below, tertiary nerves transverse, prominent on either side. Petioles 1—2.2 cm long, flat above with an indistinct narrow groove, cinnamomously tomentose. *Flowers* axillary, solitary or in 2- or 3-flowered clusters, pedicels 6—10 mm long, cinnamomously tomentose. *Sepals* broadly ovate, c. 4 by 3.5 mm, acute or subobtusate, cinnamomously or ferruginously tomentose on outside, glabrous on inside, fimbriate along margin, inner sepals smaller, with membranous margins, crested on outside. *Corolla* 6.5—9 mm, brownish sericeous on outside, but on the outside of the lobes mainly in the central part only, glabrous on inside, lobes elliptic or ovate-oblong, 3.5—5.5 by 2—2.5 mm, obtuse or acute, reflexed in flower. *Stamens* 12, 3.5—4.5 mm long, filaments filiform, c. 3 mm long, glabrous, anthers ovoid-oblong, c. 2.5 mm long, apiculate, with scattered ferruginous hairs, dehiscent extrorsely. *Ovary* ovoid-globose or disciform, c. 2.5 by 2.5 mm or 0.5 by 2.5 mm, ferruginously pilose. Style subabruptly passing into ovary, 8—15 mm long, glabrous except for a ferruginous pubescence at the base. *Fruits* unknown.

Type specimen: *Schlechter 16313* in B.

Lectotype specimen: *Schlechter 16313* in L.

Venacular name: sowkkwa (Manikiong).

Ecology: In primary and secondary forests at low altitudes.

Distribution: New Guinea.

NEW GUINEA. West New Guinea, Oransbari: *NGBW 1138, 1599* (L), tree 35—38 m, fl. Sept.; Idenburg river, Bernhard Camp, secondary forest on lower mountain slopes, alt. 100 m: *Brass & Versteegh 13543* (A, L), tree 34 m, fl. yellow-green, April — Northeast New Guinea, Wobbe, alt. 200 m: *Schlechter 16313* (G, L, S), fl. July — *doubtful specimen: NGBW 5354* (L), from Sarmi, vern. names: kanodjau (Itik, Mander), toerti (Berik).

Remarks. This species is related to *P. obtusifolium* but has shorter pedicels and less stamens. It can be recognized by the dark upper surface when dry and by the cinnamomous pubescence below.

As the type specimen is lost, the specimen in Leiden has been chosen to represent the lectotype specimen.

57. *P. morobense* van Royen, n. sp. — Fig. 13.

Arbor magna. Ramuli gracili, cinereo- vel ferrugineo-puberuli; stipulae lanceolatae, longe acuminatae, caducae. Folia elliptico-obovata, 10—15 × 4—5.5 cm, breviter obtuse acuminata, matura glabra, sed interdum in parte basali costae puberula. Nervi secundarii utroque latere 10—14, sursum evanescentes, tertiarii transversi. Petiolus (1—)1.5—2.2 cm longus, puberulus, glabrescens. Pedicellus 0.5—0.7 cm longus, cinnamomeo-puberulus. Sepala 6, extus ferrugineo-puberula, intus glabra. Corolla extus ad tubum tantum sparse puberula. Stamina 12; filamenta glabra; antherae oblongo-sagittatae, intus sparse ferrugineo-hirsutae. Ovario 6-loculare, ferrugineo-puberulum; stylus glaber. Fructus ignotus. Typus: *Clemens 8293* in L.

Tall trees. Branchlets slender, 2—4 mm in diam., greyish or ferruginously puberulous, glabrescent; terminal cone 5—10 mm long, puberulous; stipules lanceolate, up to 7 by 2 mm, long-acuminate at apex, puberulous



Fig. 13. *P. morobense*, a. branchlet with leaves and flowers; b. tertiary nervation of leaf; c. flower, only some stamens drawn; d. part of calyx, with gynaecium; e. stamen (Clemens 8293, pubescence of flowers in a. omitted).

on outside, glabrous on inside, caducous. *Leaves* scattered, elliptic-ovate, 10–15 by 4–5.5 cm, apex short obtusely acuminate, acumen up to 4 mm long, base broadly cuneate, abruptly narrowed near petiole and decurrent along the sides of the latter; juvenile leaves sparsely puberulous below, mature ones glabrous on either side but sometimes puberulous below along

the basal part of the midrib, thinly coriaceous; midrib flat or slightly grooved above, minutely crested, prominent and rounded below, secondary nerves slender, 10—14 pairs, ascending at an angle of c. 60°, curved, diminishing until inconspicuous near margin, prominulous above and sometimes grooved, prominulous below, tertiary nerves slender, transverse, rather numerous, distinct on either side, sometimes grooved above. Petioles (10—)15—22 mm long, flat above and sometimes minutely grooved in the apical part, ferruginously or greyish puberulous, but ultimately glabrous. *Flowers* in 2—5-flowered, axillary clusters, pedicels angular, 5—7 mm long, cinnamomously puberulous. Outer *sepals* triangular-ovate, 3—3.5 by 3—3.5 mm, apex subacute, ferruginously puberulous on outside and glabrous on inside, inner sepals rotundate, 2.5—3 by 2.5—3 mm, apex rounded, ferruginously puberulous on outside but glabrous along margin, glabrous on inside, margins membranous. *Corolla* 7—9 mm long, sparsely ferruginously puberulous on the tube, lobes ovate-elliptic, 5—5.5 by 2—2.5 mm, apex obtuse, reflexed in anthesis. *Stamens* 12, 4.5—5 mm long, filaments linear, 2.5—3 mm, glabrous, anthers oblong-sagittate, 2—2.5 mm long, apex obtuse, sparsely ferruginously hirsute dorsally, dehiscing extrorsely. *Ovary* disciform-obovoid, c. 1 by 1.5 mm, 6-celled, 6-lobed, ferruginously puberulous. Style stout, 3—3.5 mm long, terete, glabrous, with blackish stigmas. *Fruits* unknown.

Type specimen: *Clemens* 8293 in L.

Ecology: In rainforests at medium altitudes.

Distribution: New Guinea (and Manus?).

NEW GUINEA. Northeast New Guinea, Morobe distr., Sattelberg, 1100 m alt.: *Clemens* 8293 (A, B, L), fl. creamy brown, May.

MANUS. Loniu: *Hebblethwaite* 548 (LAE), tree 30 m, Febr., dubious specimen.

Remarks. It was first supposed, when studying the specimens mentioned above, that they could be inserted in *P. warburgianum* Schlechter. On closer study it appeared that there were some distinct differing details sufficient to establish the present new species. Its main difference with *P. warburgianum* is the smaller number of nerves. Also the base of the leaf is decurrent along the sides of the petioles instead of along the upper surface. The pubescence on the outside of the tube of the corolla is another detail different from the related species since there the corolla lobes are pubescent, though mainly in their central part. Also the shorter pedicels and the more robust buds distinguish the two species.

This species is closely related to *P. simum* from which it differs by the thicker, glossy leaves with longer petioles and by the larger flowers.

58. *P. mindanaense* Merrill, Bur. Gvt. Lab. Publ. 6, 1904, 15; Dubard, Bull. Mus. hist. nat. 15, 1909, 380; Merrill, Enum. Phil. Pl. 3, 3, 1923, 281; Lam, l. c. 1925, 105; Lam, l. c. 1927, 413.

Trees. Branchlets angular, 2—5 mm in diam., ferruginously tomentose, glabrescent; terminal cone up to 3 mm long, ferruginously tomentose; stipules lanceolate, up to 2.5 by 1 mm, acute, ferruginously tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, elliptic or elliptic-obovate (according to Merrill ovate), 11—16 by 4—6 cm, indistinctly obtusely acuminate (according to Merrill acute), base broadly cuneate, sub-

abruptly constricted into the petiole, decurrent along adaxial side of petiole; immature leaves cinnamomously puberulous on either side, mature ones glabrous, thin-coriaceous; midrib crested above, prominent and rounded below, secondary nerves slender, 13—15 pairs, ascending at an angle of 60°—70°, slightly curved or straight and curved at tips only, diminishing until inconspicuous near margin, prominulous above, prominent below, tertiary nerves transverse, slender, prominulous on either side. Petioles 28—37 mm long, thickened and wrinkled in the basal part, narrowly grooved above, young ones pubescent, mature ones finally glabrous. *Flowers* in 3- or 4-flowered, axillary clusters. *Sepals* ovate, c. 1 by 1.5 mm, obtuse, cinnamomously puberulous on outside, glabrous on inside. *Corolla*, *stamens* and *gynaecium* unknown. *Fruits* known immature only, depressedly-ovoid, c. 6 by 5 mm, glabrous.

Type specimen: *Ahern* 837 in PNH.

Lectotype specimen: *Ahern* 837 in NY.

Vernacular names: náto (Lanao), calapia (Moro).

Ecology: In primary forests at low altitudes.

Distribution: Philippines.

MENDANAO. Cottabato: *Ahern* 837 (NY), imm. fr.

59. **P. loheri** Merrill, Phil. Journ. Sc. 27, 1925, 47; Merrill, Enum. Phil. Fl. Pl. 4, 1926, 253; Lam, l. c. 1927, 413.

Trees. Branchlets terete, 3—5 mm in diam., brownish woolly tomentose, glabrescent, finely grooved; terminal cone up to 7 mm long, brownish tomentose; stipules lanceolate, up to 3 by 1 mm, acute, brownish woolly tomentose on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, spatulate or oblong-obovate, 8—15 by 3—5.5 cm, short obtusely acuminate at apex, sometimes obtuse, base narrowly cuneate, shortly decurrent along sides of petiole; glabrous above except brownish woolly-tomentose along midrib but finally glabrous, sparsely tomentose below but denser so on midrib, subcoriaceous; midrib narrowly crested above, prominent and rounded below, secondary nerves 7 or 8 pairs, ascending at an angle of 40°—55°, almost straight, stronger curved at their tips, diminishing until inconspicuous near margin, slightly grooved above, prominent below, tertiary nerves transverse, few, invisible above, very inconspicuous below. Petioles 1.5—1.8 cm long, broadly ribbed above, angular below, brownish woolly tomentose. *Flowers* in 3—7-flowered, axillary clusters, pedicels angular, 1.5—2.5 cm long, brownish woolly-tomentose. Outer *sepals* triangular-ovate, c. 3 by 3 mm, subacute, brownish woolly-tomentose on outside, glabrous on inside, inner sepals suborbicular, c. 2.5 by 2.5 mm, on outside glabrous along the membranous margins, otherwise similar to the outer sepals. *Corolla* 5—9 mm long, lobes broadly ovate, 5—6 by 3—3.5 mm, obtuse at apex, reflexed in anthesis, on outside ferruginously sericeous on tube on the middle-line of the lobes, on inside with a few hairs between the stamens. *Stamens* 12, 4—5 mm long, entirely glabrous, filaments filiform, c. 3 mm long, anthers oblong, c. 2 mm long, obtuse at apex, dehiscing introrsely. *Ovary* disciform or depressedly globose, c. 1 by 3 mm, 6-celled, 12-lobed, sparsely ferruginously sericeous at apex only, at base with an

irregularly lobed, glabrous disk, style filiform, c. 12 mm long, glabrous. *Fruits* unknown.

Type specimen: *Loher 13396* in PNH.

Lectotype specimen: *Loher 13396* in K.

Distribution: Luzon.

Rizal prov., Montalban: *Loher 12633* (CAL), fl. buds Oct. and *Loher 13396* (K), fl. April; without known loc.: *Loher 13864* (CAL), imm. fruit Jan.

Remark. Since the type specimen in Manila has been lost a new one had to be chosen from other material present in the Kew Herbarium.

60. *P. luzoniense* (F.-Vill.) Vidal, Rev. Pl. Vasc. Fil., 1886, 176; Merrill, Bur. Gvt. Lab. Publ. 6, 1904, 15; Merrill, Phil. J. Sc. 1, 1906, Suppl., 114; Dubard, Bull. Mus. hist. nat. Paris 15, 1909, 380; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 281; Lam, l. c. 1925, 60; Lam, l. c. 1927, 400 — *Dichopsis luzoniensis* F.-Vill., Nov. App., 1880, 125 — *Palaequium latifolium* Naves in Blanco, Fl. Fil., ed. 3, 2, 1880, 125, t. 423, *excl. syn.* *Bassia argentea* de Vriese, figure only — *P. ahernianum* Merrill, Phil. For. Bur. Bull. 1, 1903, 46; Merrill, Bur. Gvt. Lab. Publ. 6, 1904, 14; Dubard, Bull. Mus. hist. nat. Paris 15, 1909, 384.

Trees. Branchlets terete to subterete, 3–6 mm in diam., pale yellowish greyish, glabrous, striate; terminal cone 5–10 mm long, brownish puberulous; stipules lanceolate, up to 10 by 2 mm, apex acute, brownish puberulous, caducous. *Leaves* conferted or subconferted at apex of branchlets, oblong to subobovate, obovate or elliptic, (11–)14–17(–20) by (2.5–)4.5–6.5 (–9.5) cm, apex rarely rounded, usually obtusely to subacutely or rarely acutely acuminate, acumen 2–5(–7) mm, base cuneate, shortly decurrent along adaxial side of petiole; glabrous above, minutely brownish or dark ferruginously tomentose below, chartaceous; midrib grooved above and minutely crested, prominent and rounded below, secondary nerves (7–)9–14(–22) pairs, ascending at an angle of 60°–65°, curved or straight and curved at their tips only, diminishing until inconspicuous, prominulous above, prominent below, tertiary nervation transverse to secondary nerves but reticulate, inconspicuous or prominent on either side. Petioles 1.5–4 (–6) cm long, flat above and sometimes minutely grooved in the apical part, thickened in the basal half, minutely brownish tomentose. *Flowers* solitary or in 2–4-flowered, axillary clusters, pedicel slender, (2–)3–6.5 cm long, angular, thickened at apex, twisted and minutely ferruginously tomentose, in fruit not prolonged. *Sepals* ovate, 3–4.5 by 2.5–3.5 mm, outer ones subacute, inner ones with membranous margins and obtuse, minutely brownish or yellowish greyish tomentose on outside, glabrous on inside. *Corolla* 6-lobed, rarely 5-lobed, 10–12 mm long, lobes lanceolate, 7–8 by 1.5–3 mm, acute or subacute at apex, outside with a narrow line of ferruginous hairs in the centre, glabrous on inside, reflexed in anthesis, tube ferruginously sericeous on outside, glabrous on inside. *Stamens* 12 or 13, 9–11 mm long, filaments slender, 5–6.5 mm long, glabrous, anthers sagittate, 3–4 mm long, apex acute or bifid, densely covered with short ferruginous hairs, dehiscing laterally to subextrorsely. *Ovary* globose, c. 1.5 by 2 mm, gradually passing into the style, 6-celled, minutely ferruginously tomentose. Style subulate, c. 15 mm long, glabrous. *Fruits* when young

crowned by the long persisting style, when mature ellipsoid, c. 3.5 by 2 by 1 cm, apex mucronate, minutely brownish tomentose but soon glabrescent, one-seeded, pericarp thin, woody when dry. Seeds slightly smaller than fruit, testa crustaceous, nitidous, scar covering half of the seed, pale greyish, dull. Embryo exalbuminous, cotyledons thick.

Type specimen: *Vidal 1562* in PNH.

Lectotype specimen: *Vidal 1562* in K.

Vernacular names: salukut (Bukidnon language); araka (Ibagan language); gasátan-panalipáúen, niket (Ilocos language); salukutak (Magindaná language); tipdus, tipulo, tipulok (Manóbo language); dulitan (Pampangan language); nátoŋga-puti (Panay Bisaya language); takarang (Pangasinan language); lahas (Subanon language); kalapia, kalipaya (Sulu language); bagalaŋgit, dolitan, náto, palak-pálak (Tagalog language).

Ecology: In primary forests at low and medium altitudes.

Distribution: Philippines.

LUZON. Ilocos Sur prov.: *Klemme 5242* (BO), fl. buds, Aug. — Zamboales prov.: *Curran 5842* (SING), fl. buds, Jan. — Tayabas prov., Kinataktan: *Oro 30837* (SING), juv. fr., March; without known loc.: *Tabat 22798* (BO), fl. buds, April — Bataan prov., Lamao river: *Borden 598* (SING, fl. May; ibidem: *Borden 1918* (E), fl. buds; ibidem: *Borden 2325* (E, SING), fl.; ibidem: *Barnes 486* (BO, SING), juv. fr., Jan.; ibidem: *Barnes 179* (BO, G, SING), fl. Jan.; ibidem: *Barnes 155* (BO, SING), fl. Jan.; ibidem: *Curran 5274* (BO); Mt Mariveles: *Meyer 2254* (BO, SING), fl. Dec.; ibidem: *Meyer 2277* (SING), fl. Dec.; without known loc.: *Udasco 27188* (L, PNH), fr. April — Rizal prov., Boso-boso: *Ahern's Collector 1968* (BO, SING), fl. Nov.; San Isidro: *Vidal 1562* (K) — Manila prov., Perrottet s.n. (G), fl.

MINDORO. Bongabong river: *Whitford 1462* (BO, SING), fr. March; without known loc.: *Merritt 6788* (SING), juv. fr., March.

MINDANAO. Ayusan prov.: *Miranda 1915* (G, L, NY, SING), fl. buds, Oct.; Zamboanga distr.: *Stadtmiiller c.s. 20098* (L), fl. buds, Sept.; ibidem: *Ahern 608 & 841* (NY), fl. buds, 841 type specimen of *P. ahernianum* Merrill; ibidem: *Reillo 16497* (BM, BO, L, SING), Sept.; Surigao prov., Agusan valley: *Hutchinson 7579* (NY), July/Aug.; ibidem, Sukailang: *Mendoza & Convoocar PNII 10239* (L, PNH), tree 25 m, fl. Febr.; ibidem: *Mendoza & Convoocar 10291* (L, PNH), tree 15 m, fl. buds, Febr./March; Lake Lanao: *Clemens 1033* (G), fr.

MASBATE. Palanoe: *Vidal 3193* (K), fl. March.

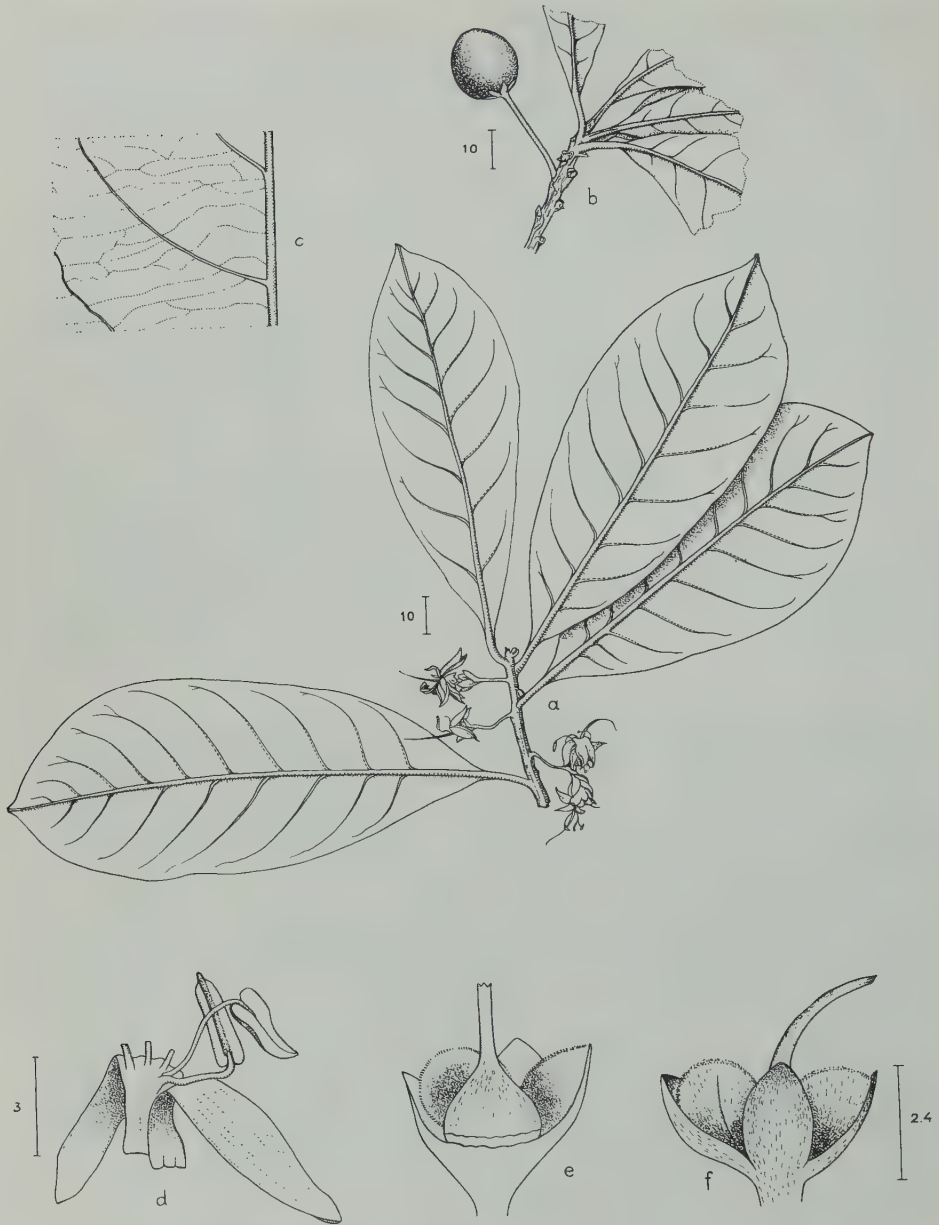
GUTMARAS. Sulaŋgun Hill, alt. 200 m: *Sulit 3666* (L, PNH), tree 7–8 m, juv. fr. March; without known loc.: *Gammill 222* (BO, SING), fl. Jan.

PANAY. Ilo-ilo prov., Mt Balutinao, Miagao: *Vidal 3186* (K), fl. March.

SURIGAO. without known loc.: *Wenzel 2981* (BO, G), fr. July; ibidem: *Wenzel 3067* (BO, G), fl. July.

Remarks. In this species two extreme forms linked by a number of intermediate forms can be found. The first one, described as *P. luzoniense* is characterized by up to 6.5 cm long, slender pedicels and the corolla exserted; a characteristic specimen is found in *Borden 2325*. The second form, described formerly as *P. ahernianum* is characteristic by up to 2 cm long, stout pedicels and corolla enclosed, as can be observed in *Ahern 608*.

61. *P. bataanense* Merrill, Bur. Gvt. Lab. Publ. 17, 1904, 44; Dubard, Bull. Mus. hist. nat. 15, 1909, 380; Elmer, Leaf. Phil. Bot. 3, 1910, 867; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 278; Lam, l. c. 1925, 37; Lam, l. c. 1927, 395 — *P. whitfordii* Merrill, Bur. Gvt. Lab. Publ. 35, 1905, 55; Merrill, Phil. Journ. Sc. 1, 1906, Suppl. 14; Dubard, l. c. 380 — Fig. 14.



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Fig. 14. *P. bataanense*, a. branchlet with leaves and flowers; b. fruit; c. tertiary nervation of leaf; d. part of corolla; e-f. part of calyx, with gynaeceum (a-c. Whitford 1204, d-f. Barnes 169).

Trees, up to 45 m. Branchlets terete, 2.5—4 mm in diam., ferruginously tomentose at apex but soon glabrous; terminal cone 3—7 mm long, brownish puberulous; stipules lanceolate, 2.5—7 mm long, apex acute, brownish or greyish puberulous on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, spatulate-obovate, 8—15 by 3—6.5 cm, apex obtuse or obtusely acuminate, acumen up to 5 mm long, base cuneate, sometimes rather narrowly so; sparsely whitish or golden tomentose above, denser so below, ultimately completely glabrous, coriaceous; midrib slightly impressed above and minutely crested, prominent and rounded below, secondary nerves 7—13 pairs, ascending at an angle of c. 60°, straight or slightly curved, indistinctly archingly joined near margins of leaf by tertiary nerves, impressed above, prominent below, tertiary nerves transverse, few, inconspicuous above, prominent below but slender. Petioles 8—25 mm long, flat above and crested, glabrous. *Flowers* solitary, or 2 or 3 in the axil of leaves or their scars, pedicels 9—24 mm long, ferruginously puberulous. Outer *sepals* ovate, 2—2.5 by 3—4 mm, apex acute, ferruginously tomentose on outside, glabrous on inside, inner sepals concnate, 3—3.5 mm in diam., apex rounded to subacute, margins membranous and ciliate, ferruginously tomentose on outside, glabrous on inside. *Corolla* 10—14 mm long, glabrous on either side, lobes elliptic-oblong, 7.5—10 by 2—3 mm, apex acute, obtuse or obtusely acuminate, reflexed in anthesis. *Stamens* 12 or 13, 7—9 mm long, filaments subulate, 4—6 mm long, glabrous, anthers elliptic-oblong, 3—3.5 mm long, apex mucronate, dehiscent laterally-introrsely, glabrous. *Ovary* ovoid, c. 2 by 3 mm, 6-celled, 6-lobed, ferruginously tomentose in the apical half only, subabruptly passing into the style which is 10—15 mm long, glabrous. *Fruits* obovoid, glabrous, 1—1.7 by 1—1.5 cm, seeds unknown.

Leectotype specimen: *Barnes 169* in K.

Ecology: A species growing in dry hill forests at low altitude.

Distribution: Luzon, Mindanao, Sibuyan, Palawan, Camiguin, Batanes.

LUZON. Bataan prov., Lamao river: *Barnes 156 & 169* (K, NY, SING), fl. Jan.; ibidem: *Barnes 496* (NY), fl.; ibidem: *Whitford 1204* (NY), fr. March; ibidem: *Whitford 1015* (PNH?), type of *P. whitfordii* Merrill.

MINDANAO. Lanao prov., vicinity of Butig, alt. 700—850 m: *Lynn Zwickney 296* (NY), tree 30 m, fl. buds, Oct.

SIBUYAN, CAMIGUIN. f. Lam, l.c. 1925, 37.

PALAWAN. f. Merrill, l.c. 1923, 279.

BATANES. without known loc.: *Fenia 3668* (NY), fr. May/June.

Remark. Since never a type specimen has been indicated from among the original material *Barnes 169* is chosen.

62. *P. tenuipetiolatum* Merrill, Bur. Gvt. Lab. Publ. 17, 1904, 45: Merrill, Phil. J. Sc. 1, 1906, Suppl. 114; Dubard, Bull. Mus. hist. nat. 15, 1909, 382; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 283; Lam, l.c. 1925, 95; Lam, l.c. 1927, 410 — *P. vulcanicum* Elmer, msc.

Trees, up to 35 m. Branchlets slender, pale ferruginously tomentose at the utmost apical part, very soon glabrous; terminal cone up to 4 mm long, tomentose; stipules lanceolate-triangular, 1.5—2 by 1—1.5 mm, apex acute, tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, lanceolate, oblanceolate or obovate, 5—12 by 3—5.5 cm, rounded and obtusely

or subacutely acuminate or caudate, acumen up to 10 mm long, base narrowly cuneate, sometimes abruptly narrowed, decurrent along adaxial side of petiole; immature scattered ferruginously tomentose, when mature entirely glabrous, or the midrib below with few appressed, ferruginous hairs, chartaceous; midrib slightly and broadly grooved above and minutely crested, prominent and rounded below, secondary nerves 10—15 pairs, ascending at an angle of 60°—65°, straight or curved, diminishing until inconspicuous near margin, prominulous on either side but slightly more so below, sometimes grooved above, almost inconspicuous at apex and base of leaf, tertiary nerves few, transverse, almost invisible on either side. Petioles 9—22 mm long, grooved and often crested above, glabrous, rarely scattered whitish or ferruginously puberulous above. *Flowers* axillary, solitary or in 2—4 flowered clusters, pedicels angular, 3—8 mm long, ferruginously pubescent. *Sepals* ovate-triangular, 2.5—3 by 1.5—2.5 mm, the outer ones smaller and thicker than inner ones, apex obtuse or subacute, inner sepals with membranous margins and sometimes crested dorsally, ferruginously tomentose on outside, glabrous on inside. *Corolla* 6—7 mm long, glabrous, lobes lanceolate or elliptic, c. 5 by 2 mm, obtuse at apex, reflexed in anthesis. *Stamens* (9—)12, c. 4.5 mm long, filaments filiform, c. 3.5 mm long, glabrous, anthers ovoid to ellipsoid, c. 2 mm long, apex bifid, ferruginously tomentose, dehiscent extrorsely. *Ovary* discoid, c. 1.5 by 0.5 mm, 6-celled, 12-lobed, ferruginously hirsute. Style subulate, grooved, 7—11 mm long, glabrous but ferruginously hirsute at base. *Fruits* ovoid or fusiform, sometimes oblique, 2.5—2.9 by 1.1—1.7 cm, 1-seeded, obtusely acuminate at apex, with a short remnant of the style, pericarp fleshy, glabrous. Seeds slightly smaller than fruit, obtuse at either end, testa thin, brownish, scar covering half of the seed, greyish, dull, embryo exalbuminous, radicle exsert, punctiform.

Type specimen: *Barnes 154* in PNH.

Lectotype specimen: *Barnes 154* in NY.

Vernacular names: akátan (Kalinga language); dolitan, dulitanpulá, mamenik, maniknik, maniknip, mayusip (Tagalog language); maliknik, maniknik, manipnip (Sambali language); manipnip (Pampangan language); paño (Ibanag language); yañgauan (Mangyan language).

Ecology: Common in primary forests and dry hill forests at low and medium altitude.

Distribution: Luzon and Mindoro.

LUZON. Bataan prov., Lamao river: *Barnes 154* (NY, SING), fl. Jan.; Mt Mari-veles, Lamao river: *Borden 1247* (SING), fl. June; Laguna prov., Mt Makiling, alt. 300 m: *Sulit 7030* (A, L, PNH), tree 20—25 m, fl. March; Sorsogon prov., Mt Bulusan: *Elmer 16303* (FI, G, L, NY, S), fr. June; ibidem: *Sulit 2686* (L, PNH), tree 20 m, fr. brownish, Aug.; Camarines Sur prov., Mt Madooy: *Edaño 76043* (SING), fl. Nov.; Tayabas prov., Pagbalao: *Merrill 1991* (SING), fl. April.

MINDORO. Without loc.: *Merritt 8599* (SING), Jan.

63. *P. foxworthyi* Merrill, Phil. J. Sc., Bot. 10, 1915, 50; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l. c. 1925, 98; Lam, l. c. 1927, 411.

Large trees. Branchlets slender, 1.5—3 mm in diam., sparsely ferruginously sericeous, soon glabrous; terminal cone up to 5 mm long; stipules lanceolate, up to 2.5 by 1 mm, acute, tomentose on outside, glabrous on

inside, caducous. *Leaves* scattered, obovate or oblong-obovate, 8—12 by 3—5 cm, obtusely acuminate at apex, cuneate at base, decurrent along side of petiole; glabrous on either side, coriaceous; midrib broadly grooved above and minutely crested as well, prominent and angular or subangular below, secondary nerves 12—14 pairs, ascending at an angle of c. 60° , curved or straight and curved at their tips only, archingly joined or diminishing until inconspicuous, prominulous above and grooved as well, prominent below, tertiary nerves transverse, hardly visible above, more so below. Petioles 5—12 mm long, flat above, angular below, glabrous. *Flowers* in 2—5-flowered, axillary clusters, pedicels angular, 8—16 mm long, sparsely ferruginously sericeous. *Sepals* ovate, 2.5—3.5 by 2.5—3.5 mm, outer ones acute or subacuminate at apex, ferruginously appressedly tomentose on outside, glabrous on inside, inner ones obtuse at apex and with glabrous, membranous margins, otherwise similar to the outer ones. *Corolla* 6.5—9 mm long, with scattered ferruginous hairs on the outside of the tube and in the middle-line of the lobes, the latter ovate-lanceolate, 5—7 by c. 2 mm, obtuse, truncate or retuse at apex, reflexed in anthesis. *Stamens* (16—)18, entirely glabrous, 5—7 mm long, filaments filiform, 3—4.5 mm long, anthers ovoid-sagittate, c. 2.5 mm long, acute or bifid, dehiscing extrorsely. *Ovary* ovoid-semi-globose, 1.5—2 mm in diam., 6-celled, 6-lobed, appressed ferruginously tomentose except for the basal part. Style filiform, 9—12 mm long, glabrous. *Fruits* unknown.

Type specimen: *Foxworthy & Ramos 13112* in PNH.

Lectotype specimen: *Foxworthy & Ramos 13112* in K.

Vernacular names: danlig, tagatoi-laláki (Tagalog).

Ecology: In primary forests at low altitudes.

Distribution: Luzon.

LUZON. Prov. of Tayabas: *Foxworthy & Ramos 13112* (K), fl. March.

64. *P. glabrum* Merrill, Phil. Journ. Sc. 10, 1915, 61 and Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l. c. 1925, 102; Lam, l. c. 1927, 412.

Trees, up to 25 mm tall. Branchlets angular, 5—8 mm in diam., glabrous; terminal cone up to 5 mm long, ferruginously puberulous; stipules lanceolate, up to 4 by 2 mm, acute, ferruginously puberulous on outside, glabrous on inside, caducous. *Leaves* conferted at tip of branchlets, obovate-oblong, (8—)12—18 by 3.2—7.2 cm, indistinctly obtusely acuminate, obtuse or rounded at apex, narrowly cuneate at base, decurrent along adaxial side of petiole; glabrous on either side, subcoriaceous; midrib grooved and minutely crested as well, prominent and rounded below, secondary nerves slender, 8—10 pairs, ascending at an angle of c. 60° , straight and curved at their tips only, or curved, diminishing until inconspicuous near margin, slightly grooved above, prominent below, tertiary nerves slender, transverse, inconspicuous and sometimes hardly visible above, prominulous below. Petioles 9—20 mm long, grooved and broadly crested as well above, angular below, thickened except for the apical fourth, glabrous. *Flowers* known in bud only, in 4—6-flowered, axillary clusters at apex of branchlets, pedicels slender, angular, 2.5—3.3 cm long, widened at apex, glabrous. *Sepals* ovate, 3—3.5 by 3—4 mm, subobtuse at apex, sparsely puberulous on outside, glabrous on inside, inner sepals more elliptic, with membranous and fimbriate

margins. *Corolla* 3—4 mm long, glabrous, lobes ovate-lanceolate, 2.5—3 by 1—1.5 mm, obtuse. *Stamens* 18, c. 3 mm long, filaments subulate, c. 1.5 mm long, glabrous, anthers oblong, c. 2.5 mm long, dehiscent laterally, ventrally with scattered ferruginous hairs. *Ovary* ovoid, c. 1.5 by 2.5 mm, 6-celled, glabrous; style cylindric, c. 2 mm long, glabrous. *Fruits* not seen but according to Lam, 1927, "ovoid, c. 3.5 by c. 2 cm, 1-seeded, glabrous; pedicels 3.1 cm long, seed exalbuminous".

Type specimen: *Ramos* 13582 in PNH.

Lectotype specimen: *Ramos* 13582 in L.

Vernacular name: alacáac na putí (Tagalog dialect).

Ecology: In primary forests at low altitudes.

Distribution: Philippines.

LUZON. Rizal prov., back of Bosoboso, in forests along streams: *Ramos* 13582 (BM, BO, L, SING), juv. fl. Aug.; Tayabas prov., Mt Dingalem: *Ramos* & *Edaña* 26627, ex litt., fr.

Remark. As the type specimen in the Manila Herbarium became lost during the war a lectotype specimen has been chosen from among the material available.

65. *P. neo-ebudicum* (Guillaumin, J. Arn. Arb. 13, 1932, 15; Lam, *Blumea* 5, 1, 1942, 34.

Trees, up to 25 m. Branchlets densely covered with scars of leaves and flowers, 3—6 mm in diam., ferruginously woolly as are the terminal cone and outside of stipules, glabrescent; terminal cone up to 6 mm long; stipules lanceolate-acicular, c. 2 by 1 mm, ferruginously tomentose on outside, glabrous on inside, caducous. *Leaves* conferted at apex of branchlets, obovate-elliptic, 11—15 by 5.5—7.5 cm, rounded or subcordate at apex, broadly cuneate at base, decurrent along adaxial side of petiole; entirely glabrous or with a few scattered hairs on either side, mainly along the midrib thinly coriaceous; midrib minutely crested above, prominent below, secondary nerves 9—11 pairs, ascending at an angle of c. 55°, straight, curved at their tips, diminishing until inconspicuous near margin or indistinctly archingly joined, above prominulous or flat and yet distinct, prominent below, tertiary nerves slender, transverse, conspicuous on either side. Petioles 2—3.5 cm long, flat and minutely crested above, ferruginously woolly. *Flowers* in 2—5-flowered, axillary clusters, pedicels slender, angular, 1.5—3.5 cm long, ferruginously woolly. *Sepals* elliptic-ovate, 4.5—5 by 3—3.5 mm, apex subacute, the inner sepals obtuse, glabrous on outside, ferruginously woolly on inside. *Corolla* seen in bud only, c. 3.5 mm long glabrous, lobes elliptic-ovate, c. 3 by 1 mm, apex obtuse. *Stamens* 12(—14), c. 2.5 mm long, filaments subulate, c. 1 mm long, glabrous, anthers oblong-sagittate, c. 1.5 mm long, apex obtusely acuminate, on inside densely ferruginously hirsute, dehiscent extrorsely. *Ovary* disciform, c. 0.5 by 1 mm, 6-celled, covered with some ferruginous hairs. Style subulate, c. 2 mm long, grooved, glabrous, mature up to 2 cm long. *Fruits* unknown.

Lectotype specimen: *Kajewski* 756 in A.

Vernacular name: ney-more-yetu (Eromanga).

Ecology: In primary forests at low altitude.

Distribution: New Hebrides (Aneityum, Eromanga).

ANETTYUM. Amelgauhat Bay, alt. 60 m, rainforest: *Kajewski 756* (A, NY), tree 20 m, fl. Febr.

EROMANGA. Dillon Bay, alt. 400 m, rainforest: *Kajewski 344* (A, NY), tree 25 m, old fl., June.

66. *P. stellatum* King & Gamble, J. As. Soc. 74, 2, Extra Nr 17, 1905, 198; Ridley, Fl. Mal. Pen. 2, 1923, 277; Lam, l. c. 1925, 71, f. 18; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1240; Lam, l. c. 1927, 402; Heyne, l. c., ed. 3, 1, 1950, 1240; Wyatt-Smith, Research Pamphlet 4, 1954, 43, fig. — *Bassia watsoni* Ridley, Fl. Mal. Pen. 2, 1923, 267 — *Madhuca watsoni* (Ridley) H. J. Lam, l. c. 1925, 179; Lam, l. c. 1927, 462.

Trees, up to 45 m. Branchlets irregularly angular, 3–5 mm in diam., ferruginously hirsute, glabrescent; terminal cone up to 4 mm long, hirsute; stipules lanceolate-acicular, c. 3 by 1 mm, acute at apex, ferruginously hirsute without, glabrous within, caducous. *Leaves* subconferted at apex of branchlets, oblanceolate, elliptic, or oblong, 7–20 by 2.5–5.5 cm, apex obtusely acuminate, acumen up to 9 mm long, base cuneate, sometimes rather narrow, decurrent along sides of petioles; subcoriaceous to chartaceous, glabrous except dark brown or ferruginously hirsute in the basal half of either side of the midrib, subcoriaceous to chartaceous; midrib above with one, sometimes with 2 minute crests, prominent and rounded below, secondary nerves slender, 9–12 pairs, ascending at an angle of 50°–60°, curved, diminishing until inconspicuous and often united by some thickened tertiary nerves near margin, prominulous but distinct on either side, tertiary nerves transverse, slender but distinct on either side. Petioles 15–36 mm long, broadly and shallowly grooved in the apical part, subincrassate at the base, densely dark brownish or ferruginously hirsute. *Flowers* in 3–5-flowered, axillary clusters, pedicels terete or angular, 12–22 mm long, brownish or ferruginously hirsute, in fruit not prolonged but slightly thickened only. *Sepals* ovate, 6–7.5 by 3.5–4.5 mm, apex obtuse or rounded, inner sepals with membranous, scarious, fimbriate margin, dark brownish or ferruginously hirsute on outside, on inside hirsute except for the central part. *Corolla* 9–10 mm long, glabrous, lobes elliptic-oblong, c. 4 by 2.5 mm, apex rounded. *Stamens* 12, 5.5–7 mm long, filaments lanceolate, angular, 3–4 mm long, glabrous, anthers oblong-lanceolate, 2–2.5 mm long, apex rounded, mucronate, sparsely brownish or ferruginously tomentose, dehiscing extrorsely. *Ovary* subglobose, c. 1.5 by 2 mm, 6-celled, dark brownish or ferruginously hirsute. Style 6–11 mm long, 6-ribbed, grooved, truncate at apex. *Fruits* subglobose (3-seeded) or ellipsoid (1- or 2-seeded), c. 2 by 2 cm or c. 2.2 by 1.2 cm, apex obtuse or rounded, with a short remnant of the style, pericarp fleshy or slightly woody, scattered brownish velutinous, ultimately glabrous (?). Seeds fusiform, laterally compressed in the more-seeded fruits, 1.5–1.8 by 0.4–0.7 cm, obtuse at apex, subobtuse at base, testa thin-cartilaginous, yellowish, nitidulous, scar linear, 2–4 mm broad, dull, greyish, embryo unknown.

Type specimen: *Scortechini 1855* in SING.

Vernacular names: Malaya: betis, bitis (Perak); nyatoh, nyatoh putat, putat bukit (Pahang); nyatoh (Malacca); belian, malung (Selangor); Sumatra: balam seminaí.

Use: The taller trees are used for the construction of canoes. Fruits edible. From the seeds a vegetable butter is extracted.

Ecology: An uncommon tree of low and medium altitudes.

Distribution: Malaya, Riouw, Sumatra.

MALAYA. Perak, Ulu Laut, Lenggong: *Hamid 10367* (KEP), tree 42 m, July; without loc.: *Scortechini 1855* (SING), fl. March — Malacca, Merliman For. Res.: *Arnot 14185* (KEP), tree 5 m, Nov.; Ayer Panas For. Res.: *Malacca 25204* (KEP), tree 16 m, fl. white; Sungei Lalang For. Res., Kajang: *Symington 24054* (KEP), tree 30 m, March — Negri Sembilan, Sungei Menyala For. Res.: *Foston 18881* (KEP), tree 25 m, fl. March — Pahang, Sungei Baloh Res.: *Abu 11002* (KEP), fl. Febr., white with disagreeable odour; ibidem: *Ycop 869* (KEP), tree 23 m, fl. March; ibidem: *Mahamud 8130* (KEP), tree 40 m, fr. July; Kuantan: *Watson s.n., ex litt., type specimen of Bassia watsonii* Ridley.

RIOUW. Kuanatan distr., Pulau Kedondong, alt. 100 m: *NIFS bb 24807* (BO, L), fr. June.

SUMATRA. Palembang, Rawas, forest on hills, alt. 100 m: *Grashoff 1010* (BO, L), tree 35 m, fr. green, March.

67. *P. merrillii* Dubard, Bull. Mus. hist. nat. 15, 1909, 381; Fedde, Repert. 11, 1912, 47; Merrill, Phil. J. Sc. 10, 1915, 62; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 281; Lam, l.c. 1925, 96; Lam, l.c. 1927, 411 — *P. lanceolatum* Merrill, Bur. Gvt. Lab. Publ. 6, 1904, 14 — **Fig. 15.**

Trees, up to 20 m. Branchlets slender, 1.5–3 mm in diam., sparsely ferruginously or blackish tomentose, glabrescent; terminal cone up to 3 mm long, tomentose; stipules lanceolate, up to 4 by 1.5 mm, apex acuminate, tomentose on outside but glabrous along margin, glabrous on inside, caducous. *Leaves* scattered, obovate, obcuneate, or oblanceolate, 5.5–14 by 2–6 cm, apex rounded or obtusely acuminate, acumen up to 2 mm long, base cuneate, decurrent along adaxial side of petioles; juvenile leaves ferruginously tomentose on either side, mature ones glabrous on either side, subcoriaceous; midrib grooved above and minutely crested, prominent and rounded below, secondary nerves 8–11 pairs, ascending at an angle of c. 50°, straight or curved, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves rather numerous, slender, transverse, subconspicuous on either side. Petioles 8–14 mm long, flat or grooved above, and crested, young blackish or ferruginously villose, ultimately glabrous. *Flowers* in 2–4-flowered, axillary clusters; pedicels angular, 5–12 mm long, ferruginously or blackish villose, in fruit up to 15 mm long. *Sepals* triangular-ovate, c. 2 by 2 mm, apex acute, blackish villose on outside, glabrous on inside, inner sepals with membranous, glabrous and fimbriate margins and obtuse apex. *Corolla* up to 7.5 mm long, entirely glabrous or ferruginously tomentose at base of tube only, lobes elliptic-oblong, c. 5.5 by 2 mm, apex obtuse or subacute, reflexed in anthesis. *Stamens* 10–12, entirely glabrous, 3–4 mm long, filaments filiform, c. 2 mm long, anthers oblong-ellipsoid, c. 2 mm long, apex obtuse and emarginate, dehiscing introrsely. *Ovary* conoid, c. 1.5 by 1 mm, 6-lobed, 6-celled, ferruginously puberulous. Style 7–8 mm long, ribbed, glabrous. *Fruits* ellipsoid, c. 2 by 1.4 cm, glabrous, 1-seeded? Seeds incompletely known.

Type specimen: *Ahern 42* in PNH.

Lectotype specimen: *Ahern 42* in P.

Vernacular names: tadkan, tagkán (Bikol language); akatan, mihat, mikat, miko (Ibanág language); yangauan (Mangyan language); bulau-búlau (Panay Bisáya language); tipudos (Sámal language); baliuhod, dolittan, dúlitan, halibis, manung-kálou, náto, palak-palák (Tagalog language).

Ecology: In primary forests at low altitudes.

Distribution: Philippines.

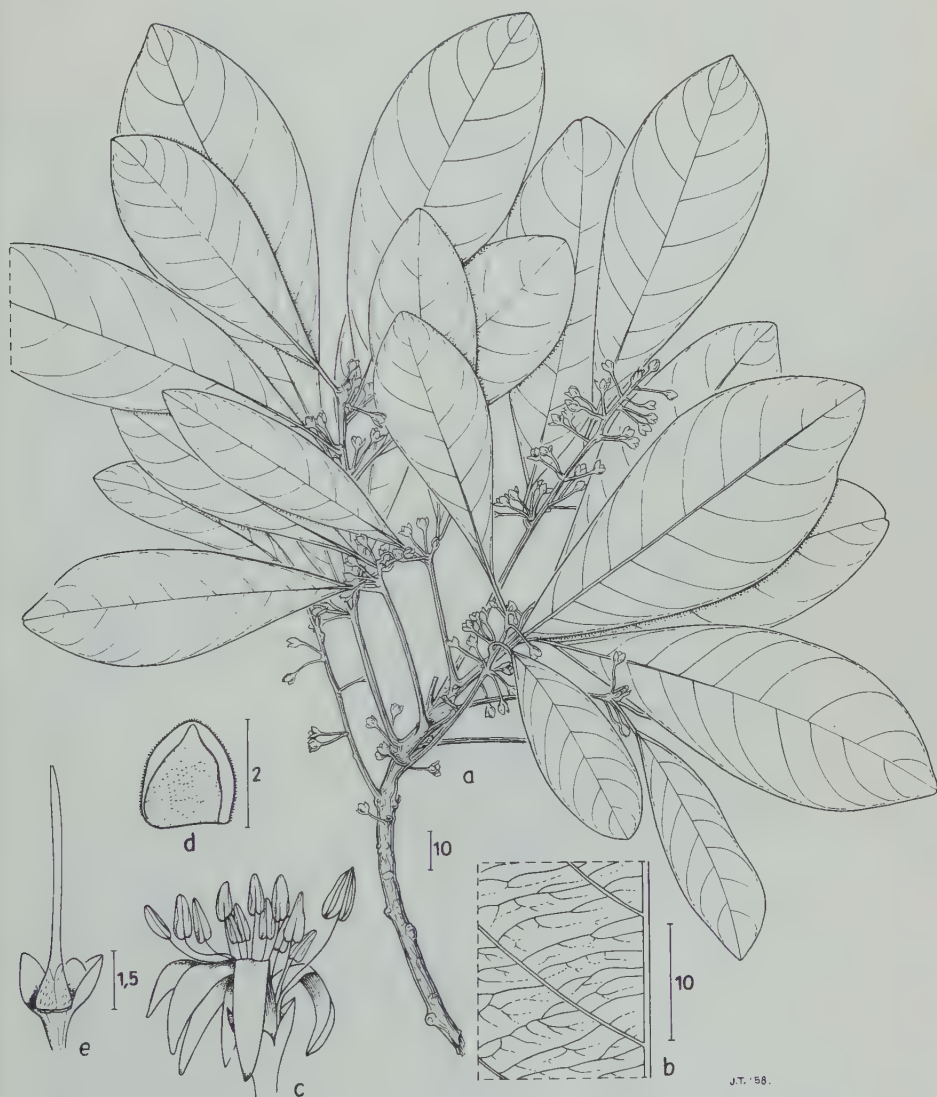


Fig. 15. *P. merrillii*, a. branchlet with leaves and flowerbuds; b. tertiary nervation of leaf; c. flower; d. inner sepal, inside; e. part of calyx; f. part of calyx and gynaeceium (Fox PNH 9017).

LUZON. Sorsogon prov., Mt Bulusan: *Elmer 15370* (FI, G, L, NY, S), fl. Dec.; *ibidem: Elmer 16029* (FI, G, L, NY, S), fl. May — Laguna prov., Mt Makiling: *Navarro PNH 9609* (L, PNH), fl. Febr.; *ibidem: Catalan 26386* (NY), fl.,

juv. fr., Febr. — Tayabas prov., Calauag: *Labaco & Masias 29350* (L, NY, PNH, SING), fl. Aug. — Camarines prov., Dalupaan, Pasacao: *Ahern 42* (P), fl. MENDANAO. Agusan prov., Butuan: *Mallonga 31210* (L, NY), tree 25 m, fl. Jan.

POLILLO. Karlagan: *Fox PNH 9017* (L, PNH), tree 20 m, fl. Dec.

BATAN. Batanes prov.: *Ramos 80609* (BO, SING), fl. June.

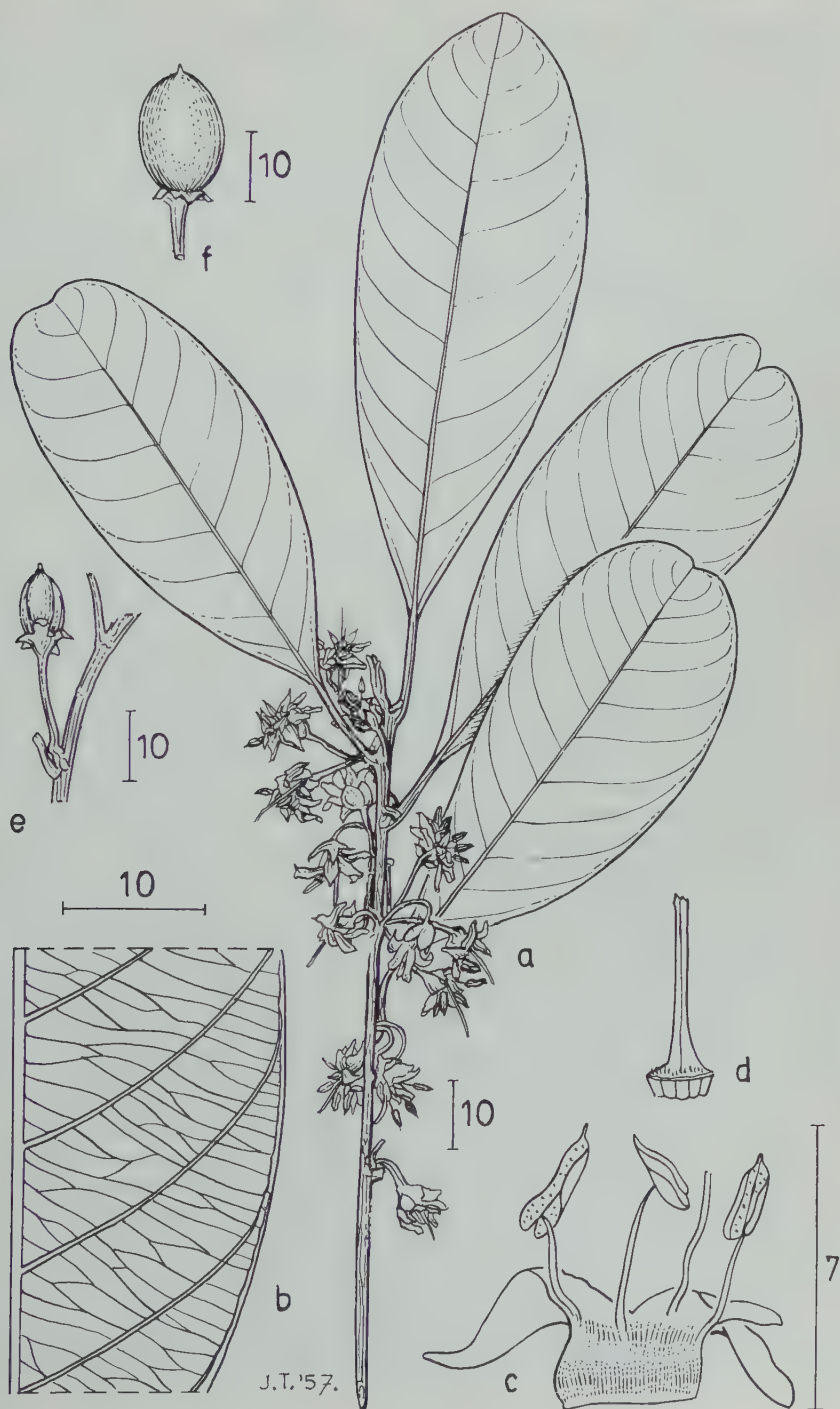
MENDORO, GUIMARAS. f. Merrill 1923, 281.

68. *P. maliliense* van Royen, n. sp. — Fig. 16.

Arbor magna. Ramuli graciles, ferrugineo-puberuli, glabrescentes; stipulae lanceolatae, acutae, caducae. Folia spathulato-oblonga vel subelliptica, 7—14(—17) \times 2.8—4(—5.5) cm, apice rotundata, obtusa vel breviter obtuse acuminata, supra glabra, subtus puberula, costa interdum glabra. Nervi secundarii utroque latere 11—15, apice connati, tertiarii transversii. Petiolus 1.2—1.8(—2.5) cm longus, ferrugineo-puberulus. Pedicellus 0.7—1.1 cm longus, ferrugineo-puberulus. Sepala 6, extus ferrugineo-tomentosa, intus glabra. Corolla glabra. Stamina 12; filamenta glabra; antherae utroque latere sparse ferrugineo-sericeum. Ovario 6-loculare, ferrugineo-sericeum; stylus glaber. Fructus ellipsoideo-ovoides, interdum obliquus, 2—2.5(—3.5) \times 1.4—1.8 cm, 1-spermus; pericarpium crustaceum; semen incomplete cognitum. Typus: *NIFS Cel. II-474* in L.

Trees, c. 30 m tall. Branchlets slender, 2—5 mm in diam., ferruginously puberulous, but soon glabrous; terminal cone up to 5 mm long, puberulous; stipules lanceolate, 2.5—3 by 1—1.5 mm, acute, puberulous on outside, glabrous on inside, soon caducous. *Leaves* scattered, spathulate-oblong or subelliptic, 7—14(—17) by 2.8—4(—5.5) cm, rounded, obtuse or short obtusely acuminate at apex, cuneate at base and decurrent along upper side of petiole; glabrous above, dark ferruginously puberulous below, sometimes midrib glabrous below, subcoriaceous or coriaceous; midrib grooved above and minutely crested, prominent and rounded below, secondary nerves slender, 11—15 pairs, ascending at an angle of c. 70°, straight or slightly curved, stronger so at apex and connected by tertiary nerves or sometimes indistinct archingly joined, prominulous above, more distinct below, tertiary nervation transverse, inconspicuous above, more distinct below. Petioles 12—18(—25) mm long, narrowly grooved above, rounded below, ferruginously puberulous. *Flowers* in 2—5-flowered, axillary clusters, or solitary, pedicels angular, 7—11 mm long, ferruginously puberulous, in fruit up to 3 cm long and almost entirely glabrous. *Sepals* ovate, the inner sepals larger than the outer ones, 2—2.5 by 1.5—2.5 mm, outer ones obtusely subacuminate at apex, inner ones obtuse, ferruginously tomentose on outside, glabrous on inside, inner sepals with glabrous, membranous and fimbriate margins. *Corolla* 6—6.5 mm long, entirely glabrous, lobes ovate-elliptic, 4—4.5 by 2—3 mm, obtuse, reflexed in anthesis. *Stamens* 12, 4—4.5 mm long, filaments linear, c. 2.5 mm long, glabrous, anthers oblong, c. 2.5 mm long, acutely acuminate, sparsely ferruginously sericeous on either side, dehiscing laterally. *Ovary* disciform, c. 0.5 by 1 mm, 6-celled, ferruginously sericeous. *Style* c. 9 mm long, 6-ribbed, glabrous. *Fruits* ellipsoid or ellipsoid-ovoid, sometimes oblique, 2—2.5(—3.5) by 1.4—1.8 cm, 1-seeded (?), obtuse at apex, with a short remnant of the style, pericarp

Fig. 16. *P. maliliense*, a. branchlet with leaves and flowers; b. tertiary nervation of leaf; c. part of corolla, with some stamens; d. gynaecium; e-f. fruit (*NIFS Cel. II-474*).



crustaceous, thin, glabrous but with numerous irregular flakes; seeds known very incompletely only.

Type specimen: *NIFS Cel. II-474* in L.

Vernacular name: Celebes: kumemotaha, nato kumé.

Ecology: In forests at low altitudes.

Distribution: Celebes and Talaud Island.

CELEBES, Menado, Pandai, alt. 400 m: *NIFS bb 33118* (BO, L), tree 40 m, Oct. — Central Celebes, Malili: *NIFS bb 1855, 1883, 2368, 2388, 13577, 23253, 32465* (BO, L), trees 24—30 m, fl. April—Oct., fr. Nov.—April; ibidem: *NIFS Cel. II-277, 278, 279, 474, 495* (BO, L, SING), tree 25—30 m, fl. April—Oct., fr. Nov.—April; Kolaka, Anaiwai: *NIFS bb 31830* (BO, L), May.

TALAUD, Karakelong, south slope of Mt Duata, alt. 60 m: *Lam 2736* (B. BO, L, SING), fl. May.

Remarks. Closely related to *P. luzoniense* but differing from that species by having smaller leaves, shorter petioles and pedicels, smaller flowers and fruits. Also the tertiary nerves are closer to each other and in general more distinct than in *P. luzoniense*.

The specimen *Lam 2736* was originally inserted by Lam in *P. luzoniense*.

69. *P. rioense* H. J. Lam, l. c. 1925, 89, f. 24; Lam, 1925, 409, f. 5.

Trees, up to 42 m high. Branchlets slender, terete, 2—5 mm in diam., orange-brown sericeous, glabrescent; terminal cone up to 9 mm long, orange-brown sericeous; stipules lanceolate, up to 7 by 3 mm, acute or acuminate at apex, sericeous on outside, glabrous within, caducous. Leaves scattered, ovate, elliptic or obovate, 5—17 by 2.5—6.5 cm, short obtusely acuminate at apex, broadly cuneate to subrotundate at base and sometimes unequal, shortly decurrent along upper side of petiole; coriaceous, glabrous above, cinnamomous or brownish orange appressedly tomentose below; midrib grooved above, prominent and rounded or subangular below, secondary nerves 11—14 pairs, ascending at an angle of c. 60°, slightly curved, at apex diminishing until inconspicuous near margin, prominulous above and slightly grooved above, prominent below, tertiary nerves slender, transverse, prominulous on either side but more distinct below. Petioles 0.8—2.2 cm long, narrowly grooved above, rounded below, sometimes ribbed, dark ferruginous, greyish brown or orange brownish sericeous. Flowers in 2—4 flowered, axillary clusters, pedicels angular, (3—)6—16 mm long, in fruit up to 20 mm, dark ferruginously or brownish appressedly tomentose. Sepals lanceolate, 3—3.5 by 1.5—2.5 mm, acute at apex, ferruginously appressedly tomentose on outside, glabrous on inside, inner sepals more rotundate, with membranous and glabrous margins, fimbriate along edges. Corolla 5—7 mm long, on outside ferruginously sericeous on the tube and in the basal part of the lobes in the middle-line, on inside ferruginously hirsute between the stamens, lobes ovate-lanceolate, 5—6 by 2.5—3.5 mm, subacute or rounded, recurved at anthesis. Stamens 12, 4.5—5 mm long, filaments filiform, 3.5—4 mm long, with few ferruginously hairs at the base, anthers ovate-oblong, c. 2 mm long, apiculate at apex, dehiscing extrorsely, with scattered ferruginous hairs on the abaxial side. Ovary broadly ovoid, c. 1 by 1.5 mm, 6-celled, 6-lobed, ferruginously sericeous. Style filiform, 9—12 mm long, with 6 grooves, glabrous. Fruits obovoid, 15 by 12 mm, 1-seeded, rounded at apex and with a circular rugose area around remnant of style,

pericarp fleshy, black, glabrous. Seeds obpyriform, slightly smaller than fruits, testa thin, scar covering about $\frac{1}{3}$ of surface of seed, embryo exalbuminous, radicle short, not exsert.

Type specimen: *Hortus Bog. IV.C.23* in BO.

Vernacular names: gëtah keras, ketipei pau, pau.

Ecology: In primary forests, mainly at high altitudes, 1200—3000 m.

Distribution: Riouw, Borneo.

RIOUW. Cultivated in Hortus Bog.: *IV.C.23* (BO, NY), fl., said to be collected on Riouw.

BORNEO. Sandakan, Mt. Kinabalu, Tenampok, Kundasang, alt. 1600 m: *Clemens & Clemens 29022* (B, BM, G, K, L, SING), tree 50 m, fr. April; ibidem, alt. 1000 m: *Clemens & Clemens 29208* (BM, G, K, L, SING), tree 50 m, fr. green, April; ibidem, Penibukan, alt. 1300 m: *Clemens & Clemens 32080* (BM, BO, L), tree 42 m, March; ibidem: *Clemens & Clemens 40446* (B, BM, CAL, G, K, L), tree 65 m, green fl., Sept., anthers pinkish; ibidem, alt. 1300 m: *Clemens & Clemens 40605* (BM, CAL, G, K, L), tree 23 m, fl. brown, Oct.; ibidem, alt. 1300 m: *Clemens & Clemens 40646 A* (BM), tree, Oct.; ibidem, Gurulau Spur, alt. 1600 m: *Clemens & Clemens 50445* (BM, CAL, G, K, L), tree 30 m, fl. Nov.; Penampang-Sensurum Track, alt. 1500 m: *Clemente 6218* (BO, SAN), tree 45 m; Bukit Kinasaraban, above Kundasan, alt. 1500 m, wooded ridge: *Sinclair, Tassim & Sisiron 3973* (E, K, L, SAN), tree 28 m, fl. greenish, June — Indonesian Borneo, W. Kutai, near Kensul river, alt. 1200 m: *Endert 3643* (BO, L), fl. Sept.; ibidem: *Endert 3620* (BO, L), juv. fr., Sept.; ibidem: *Endert 3550* (BO, L), juv. fr. & fl., Sept.

Remark. Contrary to the original description the corolla and stamens appear to be ferruginously hirsute or tomentose and not glabrous.

70. *P. lobbianum* Burck, Ann. Jard. Bot. Bzg 5, 1886, 29; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 9; Lam, l. c. 1925, 50; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1237; Lam, l. c. 1927, 398; Heyne, l. c., ed. 3, 1, 1950, 1237.

Trees, up to 34 m. Branchlets angular to terete, 2—5 mm in diam., yellowish or brownish cinnamomous to reddish ferruginously puberulous to tomentose, glabrescent and striate; terminal cone 3—8 mm long, with the same pubescence as the branchlets; stipules lanceolate to subacicular, 3—7 mm long, apex acute, on outside with the same pubescence as the terminal cone, glabrous on inside, caducous but some stipules persisting but finally also falling off. Leaves scattered to subconferted at apex of branchlets, subobovate, elliptic or oblong, 10—18 by (3.5—)5—7.5 cm, apex rounded or obtusely subacuminate, or acuminate, acumen 1—5 mm long, base broadly cuneate to rounded, very shortly decurrent along the adaxial side of petioles; brownish sericeous above but soon glabrous except in the basal part of the midrib, yellowish or brownish cinnamomous or reddish ferruginously appressedly tomentose below, thinly coriaceous; midrib narrowly to broadly grooved above and usually minutely crested in the basal part only, prominent and rounded below, secondary nerves 17—22 pairs, ascending at an angle of c. 60°, usually slightly curved, sometimes straight, curved at tips, diminishing until inconspicuous, prominulous above and sometimes grooved, prominent below, tertiary nerves transverse, slender, rather numerous, inconspicuous on either side but sometimes stronger developed below, sometimes grooved above. Petioles (1.5—)2—2.5 cm, flat above and minutely grooved in the apical part, crested below, thickened in the basal part, with

the same type of indumentum as the leaves and petioles. *Flowers* in 1—10-flowered, axillary clusters, borne on brachyblasts, pedicels in flower and fruit 5—10(—15) mm long, cinnamomous or reddish or brownish tomentose, partly glabrescent. *Sepals* broadly deltoid, 2—4 by 1.5—3 mm, apex subacute (outer sepals) or obtuse (inner sepals), ferruginously puberulous or tomentose on outside, glabrous on inside, woolly along margins, inner sepals sometimes slightly smaller than outer ones. *Corolla* up to 7 mm long, lobes narrowly elliptic, 3.5—4 by 1—2 mm, apex obtuse, scattered ferruginously sericeous on outside mainly at the base of the lobes. *Stamens* 9—12, 2.5—5 mm long, filaments angular, 1—2.5 mm long, glabrous, anthers ovoid, 2—3.5 mm long, truncate or with two short teeth, glabrous, dehiscing laterally. *Ovary* short-cylindrical, c. 1 by 1.5 mm, ferruginously pubescent, 6-celled. *Style* filiform, 6—12 mm long, sparsely ferruginously sericeous at the base. *Fruits* obliquely ovoid, 3—3.5 by 1.5—2 cm, 1-seeded, apex obtuse, with a lighter coloured rugose area of 8—12 mm in diam., attenuate at base, pericarp thin, woody, glabrous except ferruginously pubescent at the base. Seeds obliquely ovoid, slightly shorter than the fruit, testa very thin, cartilaginous, brown, nitidous, scar covering half of the seed, dull, pale brown. Embryo exalbuminous, cotyledons thick, with a deeply irregularly wrinkled surface.

Type specimen: *Resident Ternate s.n.* in BO.

Use: Straight stems are often used for the construction of canoes.

Vernacular names: Tobelo: teheriki, tehiriki; Galelo: tiwiring; Ternate: tofiri lobi-lobi; Numfoor: moref frewen; New Guinea: tiurring (Tobaru language), mora, rubia (Wokam language), sowkwa (Manikion language).

Ecology: Growing on clayey or sandy soil on flat country; in lower regions up to 250 m.

Distribution: Surigao, Batjan, Ternate, Halmaheira, Morotai, Aru Islands, Salawati, New Guinea.

SURIGAO. without loc.: *Wenzel 2975* (BO, CAL, G, K, NY), fl. June; *ibidem: Wenzel 3 L* (CAL), fl. buds July.

BATJAN. Waringin Isl., alt. c. 250 m: *NIFS bb 23158* (BO, L) and *NIFS bb 23159* (BO, L, SING), juv. fr. Aug.; Tawa Isl., Karisoeta, alt. c. 100 m: *NIFS bb 23225* (BO, L), fr. Sept.

TERNATE. without loc.: *Resident Ternate s.n.* (BO, L, SING), fl. & fr.

HALMAHEIRA. Saeo, Tobaroë, alt. 60 m: *Beguën 2087* (BO, L), tree 39 m, fr. July.

MOROTAI. Subdistr. Tobelo, old forest, alt. 30 m: *NIFS bb 33798* (BO, L, SING), tree 34 m, fl. May.

ARU ISL. Wokam, Dosinamalaoe: *Buwalda 4963* (BO, K, L, LAE, SING), fl. buds May; *ibidem: Buwalda 5119* (BO, L, PNH) fl. Jan.

SALAWATI. Kaloal, primary forest: *NGBW 4211* (HOLL, L), tree 17 m, fl. buds Oct.; Mios Waar: *NGBW 1232* (HOLL, L), tree 22 m, June; *ibidem: NGBW 1244* (HOLL, L), tree 20 m, June; *ibidem: NGBW 1298* (HOLL, L), tree 14 m, June; *ibidem: NGBW 1304* (HOLL, L), tree 18 m, June.

NEW GUINEA. West New Guinea, Vogelkop Peninsula, Inanwatan, Tisa, alt. c. 3 m, primary forest: *NIFS bb 32630* (BO, L), tree 30 m, juv. fr., May; *ibidem: Aet 7* (BO, L, SING), tree, fl. buds yellow, May; Sidai, c. 65 km W of Manokwari: *Koster NGBW 6786* (L), tree 16 m, Oct.

Remark. Sterile specimens are not easily or almost not to distinguish from those of *P. warburgianum*.

71. *P. pseudocalophyllum* H. J. Lam, Nova Guinea 14, 4, 1932, 552, t. 95 — *P. montanum* Schlechter, Gutt. u. Kautsch. Exped. etc., 1911, 94, *nomen nudum*; Krause, Bot. Jahrb. 58, 1923, 470, *descr.*

Trees, c. 35 m. Branchlets angular, 3–6 mm in diam., ferruginously appressedly tomentose, glabrescent; terminal cone up to 6 mm long, appressedly tomentose; stipules lanceolate-linear, up to 5 by 1.5 mm, acute at apex, ferruginously tomentose on outside, glabrous on inside, long persistent but finally caducous. *Leaves* conferted at apex of branchlets, obovate-oblong, (7–)12–15(–18) by 4–6 cm, rounded and short obtusely acuminate, acumen up to 3 mm long, base cuneate, decurrent along upper side of petiole; glabrous and often almost black above, ferruginously sericeous below, subcoriaceous; midrib grooved above and minutely crested in the basal part, prominulous and subangular below, secondary nerves 10–13 pairs, ascending at an angle of 50°–55°, straight but curved at their tips, diminishing until inconspicuous near margin, prominulous above and grooved as well, prominent below, tertiary nerves slender, transverse, prominulous but distinct on either side. Petioles 12–15 mm long, grooved above, angular below, ferruginously sericeous. *Flowers* in 2–5-flowered, axillary clusters, pedicels 1–1.5 cm long, brownish appressedly pilose. *Sepals* ovate, 2–4 by 2–4 mm, acute at apex, densely dark brown sericeous on outside, glabrous on inside, fimbriate at apex, inner sepals with glabrous and membranous margins and fimbriate. *Corolla* 7–8 mm long, ferruginously sericeous on outside, lobes oblong-ovate, 4–5 by 2–2.5 mm, acute. *Stamens* 12, 2.5–3.5 mm long, filament slender, 1.5–2.5 mm long, sparsely brownish woolly, anthers ovoid, 1.5–2 mm long, minutely acuminate, dehiscing extrorsely, ferruginously appressedly hirsute. *Ovary* semi-globose, c. 2 by 2 mm, 6-celled, brownish sericeous; style slender, up to 10 mm long. *Fruits* unknown.

Type specimen: *Schlechter 17750* in B.

Neotype specimen: *Hoogland 3981* in L.

Vernacular name: gamo (Orokaiva language).

Ecology: In forests at low and medium altitudes.

Distribution: New Guinea.

NEW GUINEA. Western New Guinea, along north coast: *Atasrip 48* (BO, L) — Northeastern New Guinea, Kani Mts, alt. 1000 m: *Schlechter 17750*, ex litt. — Southeastern New Guinea, near Pitoki village, S of Kokoda, alt. 400 m, in rainforest: *Hoogland 3981* (CAN, L), tree 35 m, fl. & juv. fr. Sept.

Remarks. The type specimen has been destroyed during the war and as a neotype specimen *Hoogland 3981* has been selected.

The specimens *Atasrip 7, 8, 9, 23* and *70* mentioned by Lam as belonging to this species certainly do not match *P. pseudocalophyllum* and belong to *P. lobbianum* Burck.

72. *P. lanceolatum* Blanco, Fl. Fil., ed. 1, 1837, 403; ed. 2, 1845, 282; ed. 3, 3, 2, 1878, 159; Merrill, Bur. Gvt Lab. Publ. 6, 1904, 15; ibidem 27, 1905, 57; Dubard, Bull. Mus. hist. nat. 15, 1909, 384; Merrill, Phil. J. Sc. 10, 1915, 62; Merrill, Sp. Blancoana, 1918, 301; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l. c. 1925, 103; Lam, l. c. 1927, 412 — *Bassia lanceolata* (Blanco) DC, Prodr. 8, 1844, 199 — *Dichopsis lanceolata* (Blanco) F.-Villar, Nov. App., 1883, 124 — *P. pacificum* Elmer in msc. — Fig. 17.



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Fig. 17. *P. lanceolatum*, branchlet with leaves and flowers (Ramos 19483).

Tall trees. Branchlets terete, 3—5 mm in diam., ferruginously tomentose, glabrescent; terminal cone up to 6 mm long, ferruginously tomentose; stipules lanceolate, c. 2.5 by 1 mm, acute, light ferruginously tomentose on outside, often glabrous along margins, glabrous on inside, soon caducous. *Leaves* subconferted at tip of branchlets, obovate-spathulate, 16—19 by 5—7.5 cm, obtuse and obtusely acuminate at apex, acumen 4—7 mm long, base cuneate, sometimes subabruptly narrowed close to the petiole; glabrous on either side, chartaceous; midrib slightly grooved above and narrowly crested as well, rounded below, secondary nerves 11—13 pairs, ascending at an angle of 60°—65°, curved, or straight and curved at the tips only, diminishing until inconspicuous near margin, prominulous and grooved above, prominent below, tertiary nerves transverse, very slender but distinct, more prominent below than above. Petioles 9—15 mm long, flat above and with a crest in the upper half, thickened except for the apical part, often rugose above, greyish or pale ferruginously appressedly tomentose, partly glabrescent. *Flowers* in 5—8-flowered, axillary clusters, pedicels angular, 2.5—3.8 cm long, greyish ferruginously tomentose or sericeous. *Sepals* ovate, 3—4.5 by 2.5—4 mm, subacute or obtuse, greyish or ferruginously tomentose on outside, glabrous on inside, inner sepals slightly narrower and with membranous, glabrous margins, all sepals fimbriate at apex or only slightly so. *Corolla* 8—10 mm long, glabrous, lobes linear, 7.9 by 1.5—2.5 mm, acute or subtruncate at apex, reflexed in anthesis. *Stamens* 18, 6—7.5 mm long, glabrous, but in bud the anthers with scattered ferruginous hairs, filaments filiform, 4—6 mm long, anthers sagittate-ovoid, c. 2.5 mm long, acute or truncate, dehiscing extrorsely. *Ovary* depressedly ovoid, c. 2 by 3 mm, glabrous. Style stout, filiform, 12—19 mm long, glabrous. *Fruits* fusiform or ellipsoid, 2.5—3.5 by 1.2—1.7 cm, pointed or rounded at apex, 1-seeded, pericarp thin, fleshy, glabrous. Seeds ellipsoid, 2—2.2 by 0.8—1.2 cm, testa crustaceous, scar covering about 1/4 of the surface, embryo unknown.

Neotype specimen: *Ramos 19483* in K.

Vernacular names: upong-úpong (Bikol language), araka, miko (Ibanág language), gasátan-panahipáuen, niket (Ilóko language), dulítan (Pampángan language), náto, náto-ñga-puti (Panay Bisáya language), takaran (Pangasinán language), bagalangit, dolitan, palak-palak, tagatoi, uban (Tagalog language).

Ecology: In rainforests at low altitudes.

Distribution: Luzon, Catanduanes.

LUZON. Bataan prov., Lamao river: Borden river: *Borden 1918* (E), fl. buds; ibidem: *Borden 2325* (BO, E, SING), fl.; ibidem, Mt Mariveles: *Meyer 2277* (BO, SING), fl. Dec. — Manila prov., San Mateo: *Vidal 3189* (K), fl. buds, March — Morong prov., Baras: *Vidal 1556* (K), fl. buds, Nov. — Sorsogon prov., Irosin (Mt Bulusan): *Elmer 17196* (BO, FI, G, L, NY, S), fl. buds, Sept. — Taya-bas prov., Mauban: *Ramos 19483* (K, P), fl. Jan. — without known loc.: *Vidal 7* (P), fl. buds; ibidem: *Vidal 2235* (K), fr.

CATANDUANES. without known loc.: *Ramos & Edaño 75240* (SING).

Remarks. The fruit has been described after *Ramos & Edaño 75240*.

Checking up the original description of *P. lanceolatum* Blanco it is difficult to discern which species is meant by Blanco. The problem is made still more difficult by the absence of a specimen on which his

description could have been based. According to Merrill (1918) no material of Blanco seems to be preserved.

When we try to find out whether *P. lanceolatum* Blanco was typified by later authors we find that Merrill, 1903, regards *P. lanceolatum* as the type species of the genus and subsequently mentions five specimens which belong to this species. One of them, *Merrill 1991* is according to Merrill, 1904, the type specimen of *P. tenuipetiolatum* Merrill, and the other four, according to Dubard, 1909, and Merrill, 1923, belong to *P. merrillii* Dubard (incl. *P. bataanense* Merrill). Dubard, at the same time refers *Vidal 7* to *P. lanceolatum* but according to Merrill, 1915, this specimen differs from the original description by Blanco in the corolla-lobes being rounded and elliptic instead of oblong and acute. Merrill mentions then two specimens, *Ramos 19483* and *22135* which certainly match Blanco's description. Thus still a choice has to be made which specimen should be indicated as type specimen, for which *Ramos 19483* seems to match Blanco's description in all respects.

73. *P. garrettii* Fletcher, Kew Bull. 1937, 374.

Trees, c. 28 m high. Branchlets subangular, often irregular by the numerous leaf-scars, 3.5–4.5 mm in diam., ferruginously puberulous, glabrescent, terminal cone up to 3 mm long, puberulous; stipules lanceolate, c. 1.5 by 0.5 mm, acute at apex, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered, or subconferted, elliptic, oblong, or oblong-lanceolate, 10–20 by 3.5–8 cm, apex rounded, obtuse or obtusely acuminate, acumen up to 3 mm long, base cuneate; glabrous on either side; chartaceous to subcoriaceous; midrib grooved above and sometimes indistinctly crested as well, subangular or rounded below, secondary nerves 12–16 pairs, ascending at an angle of c. 60°, straight but curved at their tips, archingly joined, or diminishing until inconspicuous and connected by thickened tertiary nerves, prominulous above, prominent below, tertiary nerves transverse but subparallel to the secondary nerves, prominulous on either side. Petioles 14–26 mm long, grooved and distinctly crested above, angular below, glabrous. *Flowers* in 3–6-flowered, axillary clusters, pedicels angular, 10–20 mm long, cinnamomously puberulous. *Sepals* ovate, 3–3.5(–4) by 2.5–3(–3.5) mm, apex subacute, puberulous on outside, glabrous on inside, inner sepals slightly larger than the outer ones, membranous, glabrous and fimbriate along margin and usually more rounded at apex. *Corolla* 7–10 mm long, entirely glabrous, lobes ovate or elliptic, 5–7 by 3–4 mm, apex obtuse and ciliate. *Stamens* 18–20, in 3 whorls, 4.5–6 mm long, entirely glabrous, filaments subulate, 2.5–3 mm long, anthers sagittate, 2.5–4 mm long, aristate at apex, dehiscing extrorsely. *Ovary* conoid, c. 1.5 by 1 mm, gradually passing into the style, 6-celled, 6-lobed, ferruginously puberulous. Style linear, 6-grooved, 9–11 mm long, glabrous, *Fruits* unknown.

Type specimen: *Garrett 113* in K.

Ecology: In rainforests at medium altitudes.

Distribution: Siam.

SIAM. Chiangmai, Doi Pa Kao, east slope, McNya river, right bank, alt. 1055 m: *Garrett 113* (BKF, K); tree, fl. Jan., pale yellow green.

74. *P. cochleariifolium* van Royen, n. sp. — Fig. 18.

Arbor magna. Ramuli irregulariter teretes, glabri; stipulae triangulares, acutae, glabrae, caducae. Folia cochleata vel obovata, (7—)10—22 \times 4—8 cm, rarius obtuse acuminata, glabri. Nervi secundarii utroque latere 6—9, sursum evanescentes, tertiarum



Fig. 18. *P. cochleariifolium*, a. branchlet with flowerbuds; b. tertiary nervation of leaf; c. flowerbud; d. inside of calyx, with gynaecium; e. stamen (*Buwalda* 7810, in a. and b. pubescence omitted).

transversi. Petiolus 1.5—4(—5) cm longus, glaber. Pedicellus 1.5—3.5 cm longus, glaber. Sepala 6, exteriora glabra. Stamina 12; filamenta distaliter longepilosa; antherae dorso longepilosae. Ovarium 6-loculare, basi sericeum; stylus glaber. Fructus ellipsoideus vel subglobosus, 2—2.5 × 1.5—2.5 cm, (semper?) 1-spermus, apice longe acuminatus, pericarpio carnosus; semen incomplete cognitum. Typus: *Buwalda 7810* in L.

Trees, up to 28 m. Branchlets stout, irregularly terete by the scars, 4—8 mm in diam., glabrous; terminal cone up to 4 mm long, glabrous, blackish; stipules triangular, c. 1 by 0.5 mm, acute, glabrous, very soon caducous. *Leaves* subconferted at apex of branchlets, cochleate or obovate, (7—)10—22 by 4—8 cm, apex rounded or subobtuse, sometimes retuse, or obtusely acuminate with an up to 1 cm long acumen, base cuneate, decurrent; coriaceous, glabrous on either side; midrib flat above and minutely crested, with 1 or 2 crests, prominent and rounded below, secondary nerves 6—9 pairs, ascending at an angle of 70°—90°, curved, diminishing until inconspicuous near margin, prominulous above and grooved, prominulous below, tertiary nerves transverse, few, usually almost indistinguishable from the reticulate nervation in between, prominulous on either side, sometimes distinct on either side. Petioles 1.5—4(—5) cm long, broadly grooved above and distinctly minutely crested, thickened in the basal part, glabrous. *Flowers* in 5—12-flowered, axillary or terminal clusters, conferted near apex of branchlets, pedicels angular, 1.5—3.5 cm long, thickened near apex, glabrous. *Sepals* ovate, 4—6 by 3—5.5 mm, apex acute but the inner ones obtuse or rounded, the outer ones glabrous on either side, the inner ones pale yellowish puberulous on outside, glabrous on inside, fimbriate along apex, margins membranous and glabrous. *Corolla* 5—11 mm long, glabrous on either side, lobes elliptic, 5—5.5 by 3—3.5 mm, apex rounded. *Stamens* 12, inserted at the base, 4.5—11.5 mm long, filaments linear, angular, 3—9.5 mm long, with long white hairs in the apical part, anthers oblong, 2.5—3 mm long, apex mucronate, with long white hairs at the back, dehiscing extrorsely. *Ovary* narrowly conoid, with the style 4—9 mm long, 6-celled, 6-lobed, whitish sericeous at the base. *Fruits* ellipsoid to subglobose, 2—2.5 by 1.5—2.5 cm, probably 1-seeded, apex long acuminate, pericarp fleshy, glabrous. Seeds unknown.

Type specimen: *Buwalda 7810* in L.

Vernacular names: Brunei: paga; Sarawak: samundo; Indon. Borneo: kain terong, kaju terong, ketiau, njatu jehrong, n. undus, n. temiang, tempang gasas.

Ecology: This species is found along the edges of peatforests, in fresh water swamps and marshes at low altitudes and sometimes along the seacoast.

Distribution: Borneo (and Malaya ?).

BORNEO. Sandakan, Beaufort distr., Klias For. Res., alt. c. 3 m: *Wood SAN 11731* (A, BRI, KEP, L, SING), tree 23 m, fl. Oct.; Padas Swamp, alt. 5 m, fresh-water swamp: *Melegrito 2827* (K, L), tree 16 m, juv. fr. Febr. — Sarawak, Sungei Pak, Btg Rejan, freshwater swamp: *Anderson S 64* (FHO, KEP), tree with buttresses, fl. Aug.; Miri, G. Dalam: *Zehnder S 1418* (KEP, SAN), tree 21 m, Dec.; Loba Kabang South P. F.: *Anderson S 653* (KEP), small tree, Jan.; ibidem: *Anderson S 657* (KEP, L, SING), small tree, Jan.; Sungei Semengon For. Res., lowland forest hills, 50 m alt.: *SAN S 207* (SAN), tree 22 m, Dec.; Sibul: *SAN S 432* (SAN), tree 10 m, March; ibidem: *SAN S 441* (SAN), tree 20 m, March; ibidem: *SAN S 653* (SAN), tree 10 m, Jan.; ibidem: *SAN S 657* (SAN), Jan.; Baram, swamp forest: *Anderson*

S 4156 (=2053) (SING), tree, Oct., *S 4192* (= 2089) (SING), tree, Oct. and *S 2867* (= 1953) (SING), tree 6 m, fl. Sept.; Tanjong Po, on shore: *Brooke 10596* (L), fl. Sept.; Badas: *Andersen 5647* (KUCH, L), tree 16 m, fl. buds Nov.; ibidem: *Wood SAN 17443* (A, BO, BRI, K, KEP, L, SING), tree 13 m, fr. April; Lingga, peat swamp forest: *Yakup 4809* (L, SAR), tree 13 m, fl. July — Brunei, Seria, Shorea albidia peat swamp: *Smythus, Wood & Ashton 5860* (L), fr. green, April, tree 22 m — S. E. Borneo, Sampit, peatforest c. 10 km NW of Sampit, alt. c. 5 m: *Buwalda 7810* (BO, L, PNH, SING), tree, fl. buds green-yellow, Sept.; ibidem, alt. 9 m: *NIFS bb 33043* (BO, L), tree, fl. Sept.; near Danau Rawah: *NIFS bb 13476* (BO, L), tree 24 m, juv. fr. green, Nov.; W. Kutai, near Hambau, inundated area: *NIFS bb 15688* (BO, L, SING), tree 28 m, fl. yellowish, Oct.

MALAYA. Pahang, Mt. Tahan: *Woolley 8225* (KEP), tree 15 m, Febr. (*dubious specimen*).

Remarks. This species is closely related to *P. hornei*. It differs from that species in the smaller number of secondary nerves and the hairy filaments and anthers.

75. *P. hornei* (Hartog) Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, 10; Lam, l.c. 1925, 107; Lam, l.c. 1927, 414; Lam, Blumea 5, 1, 1942, 33 — *Dichopsis hornei* Hartog in Baker, J. Linn. Soc. 20, 1883, 367 — **Fig. 19.**

Trees, up to 20 m. Branchlets stout, terete, 6—8 mm in diam., glabrous; terminal cone broadly conoid, c. 3 by 4 mm, subglabrous with a few white hairs; stipules lanceolate, c. 1.5 by 1 mm, apex acute, subglabrous on outside, glabrous on inside, caducous. *Leaves* crowded at apex of branchlets, oblanceolate-oblong or elliptic, 8.5—18 by 2.5—6 cm, apex obtuse, base narrowly cuneate, decurrent along sides of petioles; glabrous, coriaceous; midrib distinctly prominent and rounded on either side, secondary nerves 12—15 pairs, ascending at an angle of c. 75°, curved, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves few and slender, transverse, inconspicuous on either side, with an at the upper surface distinct reticulate nervation in between. Petioles 2—4 cm long, terete, glabrous. *Flowers* in 6- or 7-flowered, axillary clusters, pedicels terete, 2—2.5 cm long, glabrous. *Sepals* broadly ovate, 5—6 by 4—5 mm, apex obtuse, glabrous or with a few ferruginous hairs on outside, glabrous on inside, inner sepals with membranous margins and densely pale ferruginously tomentose without. *Corolla* 8—10 mm long, glabrous but for a few hairs in the centre of each lobe, tube c. 4 mm long, lobes ovate, 4—5 by 3—4 mm, apex obtuse, sometimes scarious, constricted at base. *Stamens* 12—15, entirely glabrous, 7—7.5 mm long, filaments filiform, 6—6.5 mm long, anthers oblong, 2—2.5 mm long, acuminate at apex, dehiscent introrsely. *Ovary* conoid-ovoid, c. 2 by 1.5 mm, 6-celled, 12-lobed, glabrous. Style stout, subulate, c. 5 mm long, grooved, glabrous. *Fruits* unknown.

Type specimen: *Horne 717* in K.

Vernacular name: mbulu.

Use: Good timber for building-purposes.

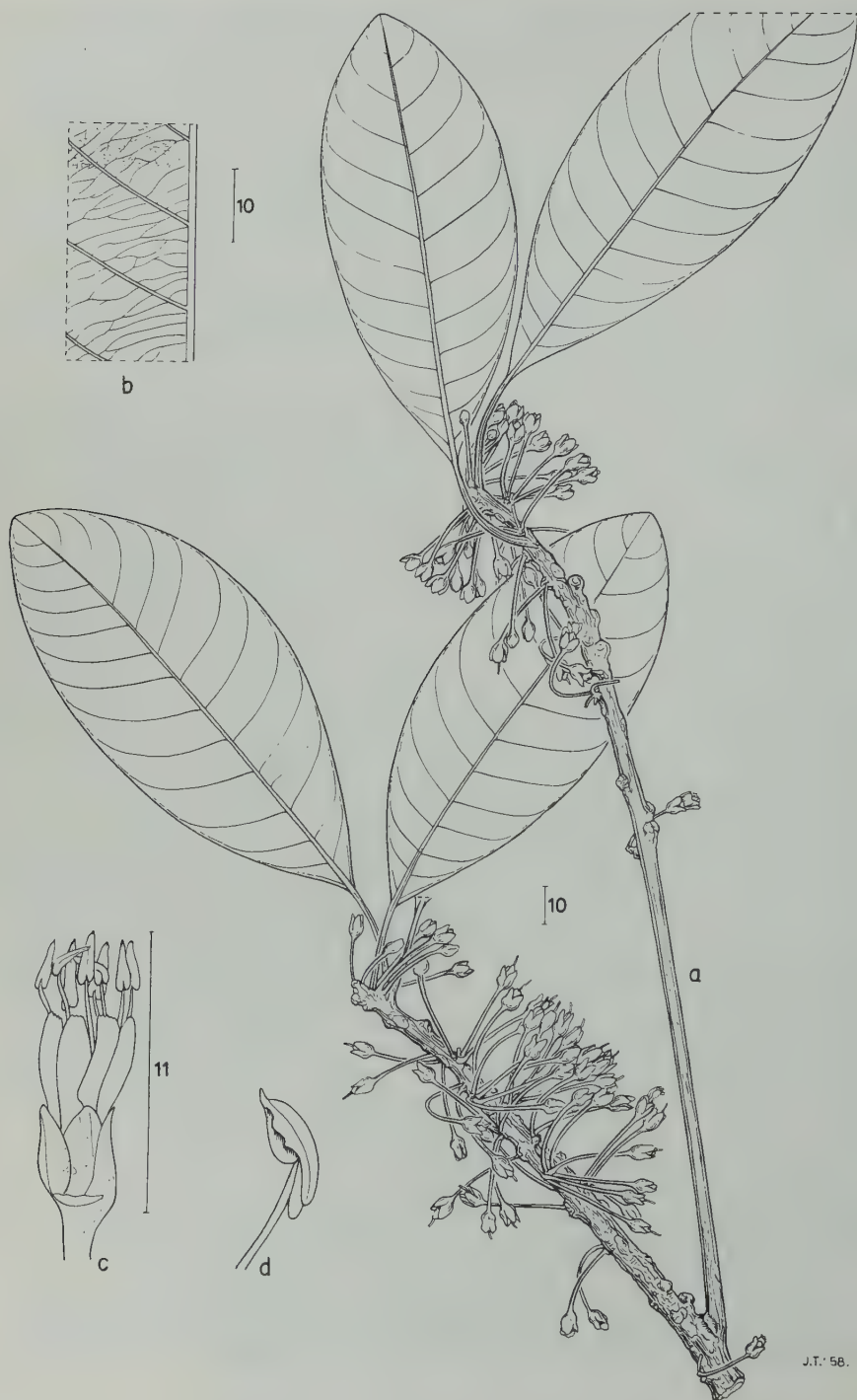
Ecology: In primary forests at low altitudes.

Distribution: Fiji (Viti Levu, Vanua Levu).

VITI LEVU. Navesi Suva forests: *Horne 717* (BO, K), fl.

VANUA LEVU. Thakaundrove, Yanawi river region, Mt Kasi, alt. 300—430 m:

A. C. Smith 1793 (A, L, S, US), tree 12—20 m, fl. white, May.



76. *P. karrak* Kanehira, Bot. Mag. Tokyo 45, 1931, 339; Kanehira, Fl. Micron., 1933, 305, f. 153; Lam, Blumea 5, 1, 1942, 34.

Trees, up to 15 m. Branchlets stout, terete, 5—8 mm in diam. glabrous, black at their tips; terminal cone up to 8 mm long, ferruginously tomentose; stipules lanceolate, up to 4 by 2 mm, acuminate at apex, crested, ferruginously tomentose on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, obovate, (15—)20—28 by (5—)8—14 cm, apex obtusely acuminate (obtuse or rotundate according to Kanehira), base cuneate, decurrent along sides of petiole; glabrous on either side, chartaceous-coriaceous; midrib crested above, prominent and rounded below, secondary nerves 10—13 pairs, ascending at an angle of c. 60°, curved, diminishing until inconspicuous near margin, crested above, prominent below, tertiary nerves slender, transverse, prominulous on either side, with an at the upper surface distinct, reticulate nervation in between. Petioles 2.5—4 cm, flat above and with 2 prominent crests, glabrous. *Flowers* in 2- or 3-flowered, clusters or solitary, axillary, pedicels terete, 2—3.5 cm long, glabrous. *Sepals* elliptic-ovate, 6—7 by 4.5—5.5 mm, apex obtuse or rounded, margins membranous and glabrous, sparsely ferruginously woolly on outside, glabrous on inside, inner sepals densely ferruginously appressedly without and with broader membranous margin than the outer sepals. *Corolla* glabrous, 9—10 mm long, lobes broadly elliptic-ovate, 4—4.5 by 3.5—4 mm, apex rounded, subattenuate at base. *Stamens* 12, entirely glabrous, filaments filiform, angular, 4.5—5.5 mm long, anthers oblong-sagittate, 2.5—3 mm long, apex acuminate, dehiscing introrsely. *Ovary* ovoid-conoid, c. 1.5 by 2.5 mm, 6-lobed, 6-celled, ferruginously puberulous. Style stout, 2.5—3.5 mm long, glabrous except at base. *Fruits* fusiform or ellipsoid, 3.8—5 by 1.5—2.2 by c. 1 cm, 1-seeded, pointed at apex, narrowed at base, pericarp fleshy, glabrous. Seeds unknown. Pedicel of fruits up to 6 cm long, glabrous.

Type specimen: *Kanehira 794* in TI.

Vernacular names: *karrak* (Kohle and Beni-shitan dialect).

Use: The wood is used for building houses and making furniture.

Ecology: In rainforests at low altitudes.

Distribution: Carolines (Ponape).

PONAPE. Niinoani-zan, alt. 350 m: *Kanehira 794* (L, NY, TI), fr. Aug.; ibidem, near Kolonia: *Kanehira 1478* (NY), fr. July; ibidem, near Nanipier: *Kanehira 1669* (L, NY), fr. July; without known locality: *Ledermann 13299, 13555, 13796* (f. Lam, 1942).

77. *P. confertum* H. J. Lam, l. c. 1925, 68, 256, f. 15; Heyne, Nutt. Pl. Ned.-Ind., ed. 2, 2, 1927, 1233; Lam, l. c. 1927, 401; Heyne, l. c., ed. 3, 1, 1950, 1233.

Trees, up to 35 m. Branchlets irregularly terete, 5—8 mm in diam., brownish woolly, glabrescent; terminal cone up to 13 mm long, densely woolly; stipules lanceolate, up to 7 by 2 mm, apex obtuse, woolly on outside, glabrous on inside, very soon caducous. *Leaves* subconferted or con-

Fig. 19. *P. hornei*, a. branchlet with flowerbuds; b. tertiary nervation of leaf; c. flower, not all stamens drawn; d. stamen (*A. C. Smith 1793*).

ferted at apex of branchlets, obovate, oblong-obovate or spatulate, (8—)10—15(—17) by 3.2—6 cm, apex rounded or shortly obtusely acuminate, acumen up to 3 mm long, base cuneate, sometimes very narrow; decurrent, glabrous above, glabrous below except densely greyish, ferruginous or brownish, or cinnamomous hirsute-woolly on midrib and nerves, thin-coriaceous; midrib slightly grooved above and minutely crested, prominent and angular below, secondary nerves (10—)13—16 pairs, ascending at an angle of 60°—70°, curved or straight and curved at their tips only, diminishing until inconspicuous near margin of leaf, minutely grooved above, prominent below, tertiary nerves slender, transverse, prominulous on either side. Petioles 1.5—3.5 cm long, flat above, with the same pubescence as the lower side of the midrib. *Flowers* in 6—12-flowered, axillary clusters, pedicels stout, 7—9 mm long, in fruit up to 12 mm long, with the same pubescence as the petioles. *Sepals* ovate-lanceolate, 2.5—4 by 2—3 mm, apex subacute or obtuse, ferruginously appressedly woolly on outside, glabrous on inside, inner sepals with scarious margins. *Corolla*, *stamens* and *gynaecium* not seen but according to Lam, 1927: "glabrous (in 1925, however, sericeo-pubescent on outside), lobes 6, narrowly oblong, apex obtuse, stamens 12, villose at the base, anthers glabrous, acuminate, ovary pubescent, style short, cylindrical, almost not exserted". *Fruits* globose, obovoid or ovoid, sometimes ellipsoid, 1.8—2.4 by 1.4—1.9 cm, 1- or 2-seeded, apex rounded, with a distinct, c. 6 mm in diam., finely rugose area, pericarp woody, glabrous. Seeds ellipsoid, c. 18 by 7 by 4 mm, mucronate, at either end, yellowish brown, nitidous, scar covering half of the seed, brownish, dull, testa thin, cartilaginous, embryo exalbuminous, radicle cylindrical, exsert.

Lectotype specimen: *NIFS* bb T 927 in L.

Distribution: Sumatra, Malaya.

Var. **confertum** — *P. confertum* H. J. Lam, var. *typicum* H. J. Lam, l. c. 1927, 401.

Petioles, underside of midrib, and secondary nerves densely hirsute-woolly.

Lectotype specimen: *NIFS* bb T 927 in L.

Vernacular names: Sumatra: balam, balam sudu.

Distribution: Malaya, Sumatra.

SUMATRA. Palembang, Lematang Ilir near Mt Megang: *NIFS* T 548 (BO, L), fr.; ibidem: *NIFS* bb T 927 (BO, L), fr. Nov.; ibidem: *NIFS* bb T 3 P 927 (BO, L), fr. Jan.; Lematang Hulu: *Grashoff* 246 (BO, L), March.

MALAYA. Johore, Kota Tinggi-Mawai Rd: *Corner* SF 30789 (SING), March.

Var. **glabrum** H. J. Lam, l. c. 1927, 401.

Leaves and petioles glabrous.

Type specimen: *NIFS* bb 8864 in BO.

Vernacular name: balam bunga.

Distribution: Sumatra.

Bengkulu, Redjang near Sukamarindu, alt. 600 m: *NIFS* bb 8864 (not seen), tree 30 m, fl. yellowish green, March.

78. **P. koratense** Fletcher, Kew Bull. 1937, 374.

Trees, c. 20 m tall. Branchlets irregularly terete, 2—5 mm in diam., ferruginously sericeous, glabrescent; terminal cone up to 5 mm long, sericeous; stipules lanceolate, c. 1 by 0.5 mm large, acute, ferruginously sericeous

on outside, glabrous on inside, soon caducous. *Leaves* conferted at apex of branchlets, oblanceolate or oblong-oblanceolate, 10—20.5 by 3—6 cm, indistinct obtusely acuminate at apex, narrowly cuneate at base, decurrent along upper side of petiole; subcoriaceous, glabrous on either side; midrib grooved above and minutely crested as well, prominent and rounded below, secondary nerves 12—18 pairs, ascending at an angle of 60°—65°, straight but curved at their tips, diminishing until inconspicuous near margin, prominulous above and grooved as well, prominent below, tertiary nerves transverse, slender, prominulous on either side but more distinct below. Petioles 1—2.2 cm long, grooved above in the apical half, rounded or angular below, finely ferruginously puberulous. *Flowers* 1 or 2 in the axils of apical leaves or their scars, pedicels angular, 1.2—2 cm long, ferruginously puberulous. *Sepals* 6 or 7, ovate-triangular, 3.5—4 by 3.5—4 mm, subacute at apex, slightly crested and ferruginously tomentose on outside, glabrous on inside, inner sepals slightly larger and more rounded than outer ones, with membranous and glabrous margins, all sepals plumulose at apex. *Corolla* 11—12 mm long, entirely glabrous, lobes 7.5—8 by 3.5—4 mm, rounded to truncate at apex, reflexed in anthesis. *Stamens* 12—14, 7—8.5 mm long, filaments filiform, 3—4 mm long, glabrous, anthers narrowly oblong-ovoid, c. 4 mm long, connective prolonged, truncate or acute, dehiscent extrorsely, with scattered ferruginous hairs on outside. *Ovary* conoid, c. 2 by 2 mm, 6-celled, 12-lobed, finely ferruginously puberulous, style stout, 12-ribbed with 6 large and 6 small wings, glabrous. *Fruits* unknown.

Type specimen: *Kerr 9966* in K.

Vernacular name: chik nom.

Ecology: In rainforests at low altitudes.

Distribution: Siam.

SIAM. Korat, Lao Lem, alt. 900 m, evergreen forest: *Kerr 9966* (K), fl. Jan.; Loie, Phu Krading, Dawn Phra Kaew, alt. 1300 m, evergreen jungle: *Smitinand 1959* (L), tree 10 m, fl. Sept.; Trang, Kantang: *Na Nakawn 1572* (L), tree, fl. Jan.

79. *P. elongatum* Merrill, Phil. Journ. Sc. 3, 1908, 257; Dubard, Bull. Mus. hist. nat. 15, 1909, 383; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 279; Lam, l. c. 1925, 61; Lam, l. c. 1927, 400.

Trees, c. 20 m high. Branchlets stout, up to 14 mm in diam., cinnamonously tomentose, glabrescent; terminal cone up to 15 mm long; stipules boat-shaped lanceolate, up to 7 by 3 mm, acute at apex, dorsally crested, ferruginously sericeous on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, narrowly spatulate or oblanceolate, or narrowly oblong-lanceolate, 18—25 by 4—8 cm, rounded and short obtusely acuminate at apex, narrowly cuneate at base, shortly decurrent along upper surface of petiole; glabrous above, ferruginously sericeous below, coriaceous; midrib grooved above and minutely crested as well, rounded and prominent below, secondary nerves 14—16 pairs, ascending at an angle of c. 40°, straight but curved at their tips, diminishing until inconspicuous near margin, grooved above, prominent below, tertiary nerves transverse, slender, prominulous or prominent above, prominulous below. Petioles 2—3.5 cm long, narrowly grooved above, rounded below, ferruginous-brownish

tomentose. *Flowers* solitary, pedicel angular, 3.5—5 cm long, ferruginously tomentose. Outer sepals ovate, up to 6 by 5 mm, acute, yellowish brown tomentose on outside, glabrous on inside, inner sepals smaller than outer ones. *Corolla* seen in bud only, c. 5 mm long, lobes ovate, up to 5 by 4 mm, subacute, ferruginously sericeous on outside except along margins, glabrous on inside. *Stamens* 18, in bud 3.5—4 mm long, filaments subulate, c. 1 mm long, glabrous, anthers narrowly lanceolate, c. 3.5 mm long, irregularly bifid at apex, ferruginously tomentose, dehiscing extrorsely. *Ovary* ovoid-disciform, c. 1 by 3 mm, 6-lobed, ferruginously tomentose, style stout, 3 mm long, glabrous, but ferruginously tomentose at base. *Fruits* unknown.

Type specimen: *Reyes 6620* in PNH.

Neotype specimen: *Alvarez 22370* in K.

Vernacular names: Luzon: palak-palák, tañgileng-pulá (Tagalog language).

Ecology: In primary forests at low altitudes.

Distribution: Luzon.

LUZON. Nueva Ecija prov.: *Alvarez 22370* (K), fl. buds, Febr. — Taya-bas prov.: *Reyes 6620*, ex litt.

Remark. Since the type specimen has been destroyed a new one has to be chosen.

80. *P. vitilevuense* Gilly, n. sp. — See p. 606.

Trees, up to 6 m. Branchlets stout, terete, c. 6 mm in diam., ferruginously woolly, glabrescent; terminal cone up to 7 mm long, ferruginously woolly; stipules lanceolate, c. 3 by 1 mm, acute at apex, woolly on outside, glabrous on inside, caducous. *Leaves* conferted at apex of branchlets, elliptic-oblong, 10—20 by 3.5—4.5 cm, apex rounded or obtuse, base rounded; subulate, glabrous on either side except ferruginously or whitish woolly at base of midrib, sometimes only so below, chartaceous, midrib slightly grooved above, prominent and rounded below, secondary nerves slender, 17—25 pairs, ascending at an angle of 65°—90°, slightly curved, diminishing until inconspicuous near margin, sometimes indistinctly archingly joined, prominulous above, prominent below, tertiary nerves very slender, transverse, inconspicuous on either side. Petioles 1.5—2 cm, ferruginously woolly, crested above. *Flowers* 1 or 2 in each axil, pedicels angular, 15—18 mm long, ferruginously woolly. *Sepals* broadly ovate, 5—6 by 4.5—5.5 mm, apex obtuse or obtusely acuminate, ferruginously woolly on outside, with a bundle of darker and longer hairs at apex, glabrous on inside, inner sepals crested at base and with longer hairs. *Corolla* seen in bud only, c. 3 mm long, margins ferruginously fimbriate, lobes suborbicular, c. 2.5 by 2.5 mm, obtuse. *Stamens* 12, c. 2 mm long, filaments subulate, c. 0.5 mm, glabrous, anthers oblong-ovoid, 1.5—2.5 mm long, 2-lobed at apex, ferruginously tomentose on either side, dehiscing extrorsely. *Ovary* disciform, c. 1 by 2 mm, 6-celled, ferruginously pubescent. Style stout, subulate, c. 2.5 mm long, glabrous. *Fruits* unknown.

Type specimen: *Greenwood 914* in NY.

Ecology: In forests along creeks at c. 550 m altitude.

Distribution: Fiji (Viti Levu).

VITI LEVU. Lautoka, mountains near Lautoka, alt. c. 550 m, at edge of creek among hills: *Greenwood 914* (K, NY), tree 6 m, fl. pale yellowish green, May.

81. *P. gutta* (Hooker f.) Baillon, Tr. Bot. Med. Phan., 1884, 1500, Add., f. 3290; Pierre, Bull. Mens. Soc. Linn. Paris 1, no 63, 1885; Merrill, Enum. Born. Pl., 1921, 480; Lam, l. c. 1927, 387, f. 1; Lam in Backer, Noodfl. Java 7, 1948, Fam. 166, p. 10; Corner, Wayside Trees, ed. 2, 1, 1952, 600; Wyatt-Smith, Research Pamphlet 4, 1954, 32, fig. — *P. gutta* f. *borneense* H. J. Lam, l. c. 1927, 389, f. *genuinum* H. J. Lam, l. c. 1927, 390, f. *vrieseanum* H. J. Lam, l. c. 1927, 391 — *Isonandra gutta* Hooker f., London Journ. of Bot. 6, 1847, 463, t. 16; Teyssmann, Nat. Tijdschr. Ned.-Ind. 1, 1850, 435; de Vriese, Tuinb. Fl. 3, 1856, 223; de Vriese, Pl. Ind. Bat. Or., 1856, 59; Miquel, Fl. Ind. Bat. 2, 1859, 1038 t. 36; Bentley & Trimen, Medical Pl., 1880, t. 167; Beauvisage, Contr. Etud. Gutt.-Percha, 1881, 15, 28; Burek, Med. Lands Pl. Tuin 1, 1884, 3, 17 — *I. gutta* Hooker f., var. *oblongifolia* de Vriese, Tuinb. Fl., 1856, 225, fig.; de Vriese, Pl. Ind. Bat. Or., 1856, 60 — *I. gutta* Hooker f., var. *sumatrana* Miquel, Fl. Ind. Bat. 2, 1859, 1038; Miquel, Fl. Ind. Bat., Suppl. (1860) 581 — *Palaquium gutta* Burek, Ann. Jard. Bot. Bzg 5, 1886, 24, t. 1; Dubard, Bull. Soc. Bot. Fr. 56, 1909, Mém. 16, p. 14; Lam, l. c. 1925, 27, f. 3 & 4; Heyne, Nutt. Pl. Ned.-Ind., ed. 3, 1, 1950, 1234 — *P. gutta* Burek, f. *borneense* (Burek) H. J. Lam, f. *genuinum* H. J. Lam, with the subformae *gutta* H. J. Lam and *oblongifolium* (Burek) H. J. Lam, f. *selendit* (Burek) H. J. Lam, and f. *vrieseanum* (Burek) H. J. Lam, l. c. 1925, 28—31, 253 — *P. gutta* Burek, var. *curtisii* Ridley, Fl. Mal. Pen. 2, 1923, 275 — *P. gutta* Burek, var. *oblongifolium* King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr 17, 1905, 192, 402 — *P. gutta* Burek, var. *sessiliflora* Boerlage, Bull. Inst. Bot. Btztg 5, 1900, 21; Merrill, Enum. Born. Pl., 1921, 480 — *P. acuminatum* Burek, Ann. Jard. Bot. Btztg 5, 1886, 40; Heyne, Nutt. Pl. Ned.-Ind., ed. 3, 1, 1950, 1232 — *P. borneense* Burek, Ann. Jard. Bot. Btztg 5, 1886, 25, t. 6; Dubard, Bull. Soc. Bot. Fr. 56, 1909, Mém. 16, p. 12; Heyne, Nutt. Pl. Ned.-Ind., ed. 1, 4, 1917, 16 — *P. borneense* Pierre, *P. formosum* Pierre, *P. malaccense* Pierre and *P. princeps* Pierre, Bull. Soc. Linn. Paris 1, 1883, 496 — *P. ellipsoideum* Beccari, For. Born., ed. 1, 1902, 560 — *P. fulvosericum* Engler, Bot. Jahrb. 12, 1890, 511; Dubard, Bull. Soc. Bot. Fr. 56, 1909, Mém. 16, p. 9; H. J. Lam, l. c. 1925, 48, *Bornean specimens only* — *P. gloegloerense* Burek, Ann. Jard. Bot. Btztg 5, 1886, 40 — *P. leiocarpum* Boerlage, var. *longe-acuminatum* Boerlage, Bull. Inst. Bot. Btztg 5, 1900, 25 — *P. oblongifolium* (Burek) Burek, Ann. Jard. Bot. Btztg 5, 1886, 25, t. 5; Burek, Med. Lands Pl. Tuin 3, 1886, 40; Dubard, Bull. Soc. Bot. Fr. 56, 1909, Mém. 16, p. 15; Heyne, Nutt. Pl. Ned.-Ind., ed. 1, 4, 1917, 20; Koorders, Atlas Baumart. Java 4, 1918, t. 614 — *Dichopsis oblongifolia* Burek, Med. Lands Pl. Tuin 1, 1884, 21 — *Palaquium obscurum* Burek, Med. Lands Pl. Tuin 3, 1886, 40 — *P. optimum* Beccari, For. Born., ed. 1, 1902, 152, 558, f. 30, 31; Beccari, l. c., ed. 2, 1921, 110, f. 30; Lam, l. c. 1925, 35; Lam, l. c. 1927, 391 — *P. selendit* Burek, Med. Lands Pl. Tuin 3, 1886, 41; Heyne, Nutt. Pl. Ned.-Ind., ed. 3, 1, 1950, 1240 — *P. tammedak* Beccari, For. Born., ed. 1, 1902, 559; Lam, l. c. 1925, 106 — *P. treubii* Burek, Med. Lands Pl. Tuin 3, 1886, 28, incl. var. *parvifolium* Burek — *P. vrieseanum* Burek, Ann. Jard. Bot. Btztg, 5, 1886, 28 — *P. vrieseana* Pierre in Beccari, For. Born., ed. 1, 1902, 558.

Trees, up to 45 m. Branchlets subterete or angular, 2—6 mm in diam..

purplish or reddish brown, golden-coloured, or greyish tomentose or sericeous, glabrescent; terminal cone up to 10 mm long, brownish or reddish brown, gold-coloured or greish tomentose or sericeous; stipules lanceolate, 1—2 mm long, apex acute, purplish or reddish brown, golden-coloured, ferruginously, or light or dark greyish tomentose or sericeous on outside, glabrous on inside, caducous. *Leaves* very variable in shape and size, sometimes even along the same branchlet, conferted or subconferted along tip of branchlets or scattered, obovate, spatulate, ovate, ovate-oblong, elliptic or obovate- or elliptic-oblong, (8—)12—17(—50) by (2.5—)4.5—6.5(—12) cm, apex rounded, obtuse or obtusely or acutely acuminate, acumen up to 3.5 cm long, base broadly or narrowly cuneate, decurrent along adaxial side of petiole; sparsely whitish puberulous above but soon glabrous, densely brownish, light or dark greyish, golden-coloured, ferruginous, reddish or purplish tomentose or sericeous below, sometimes ultimately glabrous, coriaceous; midrib grooved above, prominent and rounded below with a few grooves, secondary nerves (9—)16—20(—33) pairs, ascending at an angle of 45° — 50° (— 90°), straight and curved at their tips only, archingly joined very close to the margin of the leaf or diminishing until inconspicuous, prominulous above, prominent below, tertiary nerves slender or stout, transverse or subparallel, or parallel to the secondary nerves, sometimes reticulate, prominent or inconspicuous on either side but usually slightly more distinct below. Petioles (0.7—)3—4.5(—6.5) cm long, broadly or narrowly grooved above but the groove diminishing in size down to the basal fourth, rounded and with a few grooves below, brownish, golden-coloured, cinnaomous, or ferruginously tomentose, or sericeous below. *Flowers* in (2—)4—7(—10)-flowered, axillary clusters, pedicels angular, (1.5—)5—9(—12) mm long, with the same type of indumentum as the leaves. Outer *sepals* ovate, 3—4 by 2—3.5 mm, apex obtusely acuminate, tomentose or sericeous on outside in the same colours as the leaf, glabrous on inside, inner sepals ovate-oblong, 2.5—4 by 1—2.5 mm, apex obtuse, margin membranous and fimbriate, tomentose on outside, glabrous on inside. *Corolla* up to 9 mm long, glabrous, lobes elliptic-ovate, up to c. 6 by 2 mm, apex obtuse, ciliate at apex, reflexed in anthesis. *Stamens* 12, 4.5—7 mm long, filaments lanceolate, 3.5—4 mm long, glabrous, anthers sagittate, 2—2.5 mm long, apex aristulate, glabrous, sometimes with a few hairs, dehiscing extrorsely. *Ovary* ovoid, c. 1 by 2 mm, 6-celled, brownish tomentose. Style filiform, 6—9 mm long, pubescent at base, apex with 6 small, lighter coloured streaks. *Fruits* globose, ellipsoid, or ovoid, 2—3.5 by 1—3 cm, rounded, obtuse or acuminate at apex, rounded or attenuate at base, 1- or 2-seeded, pericarp thin or fleshy, minute and densely ferruginously tomentose, sometimes glabrescent. Seeds ovoid or ellipsoid, 1.2—3 by 1—1.7 by 0.6—1 cm, obtuse at both ends, olivaceous brown, brown or dark brown, testa thin, embryo exalbuminous, cotyledons thick, radicle not or slightly exsert.

Type specimen: *Lobb 290* in K.

Vernacular names: Perak: taban putih, t. sutrah; Penang: ekor, daun durian, gētah taban, taban merah; Selangor: taban merah, t. putih; Johore: sontai manyang; Riouw: gētah putih, taban pertjah; Bangka: dadau; Sumatra: balam abang, b. pipiet, b. putih, b. saso, b. tebaga, b. tembaga, b. timah, durian taban, genēng, guttah pertjah, majang batuh, m. bolon,

m. buluk, m. durian, m. gerindjing, m. kapur, m. merah, m. pertjah, m. rapuk, njato balam susun, m. selendit, m. surian, seluwai; Java: suntek; Borneo: djankang, djunkang, gëtah durian sambung, g. keras, g. kribang, g. merah, g. merah nomor satu, g. puah, g. sambung, g. semalan, ketapedian, ligayan, natu rupui, njato barak, n. durian, n. rian, n. tamiang, padang njato djangkar, rapok palung, samban tewadah, s. weja, asmban, sambung.

Use: This species yields a rubber which can be used for the manufacture of chewing-gum. It is the best gëtah-producing tree. But its most important use is for the manufacturing of sheets used for covering cables to be laid in seawater. The seeds are said to produce a very good wax for the manufacture of soaps and candles. Often the fat is used in the preparation of food. According to extensive studies of the yield of guttaperchah those trees belonging to the former forms borneense and gutta seem to produce a guttaperchah of higher quality than those of the form selendit (see Heyne, Nutt. Pl. Ned-Ind., ed. 3, 1950, 1235). It is on account of the producing of an inferior gëtah that Heyne keeps *P. acuminatum*, *P. selendit* and *P. trenbii* apart from *P. gutta*, but a distinction on chemical substances alone seems not to justify the separation of species with so many systematical features in common. It only proves that within one single species a large range of possibilities can be enclosed.

Ecology: This species seems to be restricted to lowland forests but is found up to 1600 m. In Penang (Malaya) it is flowering from January to April, but in the centre and middle of the Malay Peninsula it flowers from July to September. In the other regions of its area no definite time of flowering seems to be present.

Distribution: Though this species is often cultivated, originally it has been found on the Malay Peninsula, Sumatra, Borneo and some surrounding islands only. It seems to be introduced on Java where the government has been trying to cultivate it at Tjipetir on Western Java already for a long time with varying results.

MALAYA. Penang, Telok Bahang: *Mahamud 9567* (SING), fl. April; Pulau Penang, Waterfall Valley: *Curtis 3535* (CAL, SING), fl. Jan.; ibidem, Highland Hill, alt. 300 m: *Curtis 3582, 3633 ♂ 3636* (SING), tree, fl. Nov.; Government Hill, alt. 400 m: *Curtis 780* (SING), April; Batu Terenggy: *Curtis s.n.* (SING), fr. June; ibidem, alt. 250 m: *Curtis 3634* (SING), tree, fl. March; Botanical Garden: *Henderson 110* (SING), fl. Jan.; ibidem: *Nur 3666* (SING), juv. fr. — Perak, Taiping: *Stephens s.n.* (SING), fr. Aug.; ibidem: *Curtis 3637* (SING), Oct.; Plus river: *Wray 522* (CAL, SING), fr.; Keledang: *Hill s.n.* (SING); Larut, Waterfall: *Curtis 3725* (CAL, SING), Dec.; ibidem: *King's Coll. 6475* (CAL), fl. Aug.; Dindings: *Bryant s.n.* (SING), March — Pahang, Kuala Lipis: *Burn-Murdoch s.n.* (SING), Sept.; Permatang (Temerloh): *Idris CF 6314* (SING), fl. Sept. — Selangor, Semangka Pass, alt. 800 m: *Hill s.n.* (SING), Aug.; Rantau Panjang: *Strugnell 14507* (SING), fr. Dec.; Kanching Res.: *Ahmad CF 5706* (SING), fr. Nov. — Negri Sembilan, Senawang Res.: *CF 530* (SING), fr. Febr.; Mt Angzi For. Res.: *Sow 23766* (SING), fr. Dec.; Serembang: *Hudson s.n.* (SING), July; Bukit Tangga: *CF 532* (SING), fr. March — Malacca, Kuala Lumpur, Bot. Gardens: *Hamid CF 4916* (SING), fr. Sept.; Weld Hill Res.: *Hamid CF 4967* (SING), fr. Nov.; ibidem: *CF 3897* (SING), fl. July — Johore, Johore Baru: *Nong Chie s.n.* (SING), fr. March; Muar river, Biaivak: *Curtis 3632* (SING); Pontian Besar: *Kassim bin Andeng 52408* (KEP), Nov. — Singapore, Pulau Damar: *Aman s.n.* (SING), Sept.; Bot. Garden: *Nur s.n.* (SING), tree 5 m; ibidem: *Ridley 9519* (CAL, SING), fl. Sept.; Bukit Timah: *Sinclair s.n.* (L, SING), fr. Jan.; ibidem: *Nur s.n.* (SING), Oct.; ibidem: *Fox 11306* (SING), Aug.; without known loc.: *Lobb 290* (K, GL, SING), fl.; ibidem: *White s.n.*

(NY) — without known state: Sungei Ujong: Batu Kupayang: *Malvius* 2199 (SING), Nov.; *Mangay* 983 (K, L).

RIOUW. without known loc.: *Wahlbeem s.n.* (L).

SUMATRA. Padang Sidempuan, Padang Lawas: *Rahmat Si Torus* 5634 (A), Sept.; ibidem, Pulo Liman: *Rahmat Si Torus* 5261 (A) & 5265 (A, L), Aug.; Padang, Ayer Mantjur: *Beccari s.n.* (FI), Aug.; Mt Sago near Pajakumbuh: *Maradjo* 205 (L), tree 5 m, July; Pematang Siantar, alt. 700 m: *NIFS* bb 20394 (BO), tree 31 m, March; Huta Padang Estate, near Kisaren: *Krukoff* 229 (BO, NY), tree, Dec.; ibidem: *Krukoff* 211 & 217 (BO, NY, SING), Dec.; Indragirian Uplands, Keritang: *NIFS* bb 28666 (BO, L), July; ibidem: Muras Serange, alt. 75 m: *NIFS* bb 30024 (BO, L), Sept.; without known loc.: *Curtis* 3630 (SING), Jan.

JAVA. Banjumas, Upper Baturaden, alt. 800—1000 m: *Drescher s.n.* (BO, L), April.

BORNEO. Sandakan, Mt. Kinabalu, Penibukan, 1300—1600 m alt.: *Clemens & Clemens* 21232 (A, BM), tree 43 m, fr. green, Febr.; ibidem, alt. 1600 m: *Clemens & Clemens* 40571 (CAL, G, K, L), tree 20 m, fl. buds, Oct.; ibidem: *Clemens & Clemens* 50331 (G, K, L, CAL), tree 30 m, Nov.; Gurulau Spur, alt. 1700 m: *Clemens & Clemens* 50695 (CAL, E, G, K, L), tree 20 m, fl. Dec.; Tenompeh, alt. 1600 m: *Clemens & Clemens* 30066 (BO), tree 13 m, June; Penampang-Sensaron Track, hill, alt. 1200—1600 m: *Keith* 5929 (K, L, SAN, SING), tree 20 m, June; ibidem, alt. 1300 m: *Leano-Castro* 5987 (K, L), tree 20 m, July; Sambas: *Dunnal s.n.* (SING), March; Sipitang, Ulu Mendalong, alt. 800 m: *Wood SAN* A 16816 (L, SAN), fl. Oct., tree 27 m; ibidem, alt. 550 m: *Wood SAN* A 16784 (L, SAN), tree 45 m, fr. Sept.; Kimanis For. Res.: *Kwan Ting A* 354 (KEP), fl. yellow, May — Sarawak, Kuching: *Beccari s.n.* (FI); ibidem: *Beccari* 88 (FI); without known loc.: *Beccari* 2097 (FI), fl.; ibidem: *Beccari* 2269 (FI, S), fl., type specimen of *P. sambasense* Pierre; Sungei Paoh, Sarikei: *Danyut* 1116, A 1274 (SAR), fl. buds, March; Setapak For. Res.: *Egon* 612 (SAR), fl. April; Limpang Tiga, hilly ground: *Egon* 349, 358 (SAR), tree 20, fr. Nov.; Kuching: *Beccari s.n.* (FI); Jesselton distr., Beaufort: *Cuadra* A 1347 (SING), April; Bongawen: *Rahman* 55176 (SING), Nov.; Kabil For. Res.: *Puasa* 10230 (K, L), Dec.; Kuching: *Beccari* 88 (FI), type specimen of *ellipsoideum* Beccari; ibidem: *Beccari s.n.* (FI), type specimen of *P. magnoliifolium* Beccari; ibidem: *Beccari* 2097 (FI), type specimen of *P. tammedalk* Beccari — Indonesian Borneo, Pontianak: *Teysmann s.n.* (BO, L), fl.; Sambag: *Teysmann s.n.* (BO, P), fl. & fr.; Muara Teweh, Lemu Malaju, alt. 15 m: *NIFS* bb 28088, 28089, 28749, 28750 (A, BO, L, SING), June/July; ibidem: *NIFS* bb 29211, 29760, 29676 (BO, L, SING), fl. Sept., fr. Oct.; ibidem: *NIFS* bb 29694 (BO, L), fr. Nov.; Muarah Teweh, Hadak, alt. 25 m: *NIFS* bb 21260 (BO), July; Danau Rawah, Lower Dajak river: *NIFS* bb 19479 (BO), 23465 (BO, L), Nov.; Tidang Uplands, alt. 15 m: *NIFS* bb 18253 (BO), tree 38 m, Nov.; Kubu distr., Pulu Limbu, alt. 5 m: *NIFS* bb 12644 (BO), tree 21 m, June; Puruk Tjahu, Takundjan, alt. 75 m: *NIFS* bb 20443, 21198 (BO, L), March/July; ibidem, alt. 175 m: *NIFS* bb 21211 (A, BO, L, SING), June; ibidem, alt. 350 m: *NIFS* bb 20444 (BO, L), March; Sanggau-Sekadan, Meliau, alt. 50 m: *NIFS* bb 23599 (A, BO, L), Dec.

Remarks. In studying the abundance of material before us it seems hardly justified to accept the four forms described by Lam in 1925 and 1927, viz *f. gutta* (Lam's forma *genuinum*), *f. vrieseanum*, *f. borneense*, and *f. selendit*. When using the term "forma" one has in mind that there are more or less sharply defined unities in the species, though the differences between these forms are of a definitely lower level than the differences between species or varieties. This, however, is impossible to carry out in *P. gutta* as so many specimens show in-between characteristics. Moreover, it appeared that, when including new material in each of the four forms, their delimitations had to be expanded, thus obscuring the distinct lines between them. E. g. in forma *gutta*, Lam mentions the number of secondary nerves to be 20—30 pairs, but new material brings this number to 14—30. In forma *borneense* the pedicels are said to reach 0.7 cm sometimes, but now

pedicels of 1.1 cm are found. In forma *selendit* the number of secondary nerves is found to be 9—16 pairs, instead 14—16. Discarding thus the four forms as taxa it is worthwhile to mention the two trends discernable in this species.

With the material before us it is clear that one group of specimens usually has narrowly elliptic or lanceolate leaves and the other group usually more obovate leaves. In the first group the apex is often longly acuminate but rounded leaves are found as well. In the second group usually rounded leaves are found, but acuminate leaves are reported too. Interpreting these two groups in Lam's terms the first group comprises f. *gutta* and f. *viroseanum* and the second group includes f. *borneense* and f. *selendit*.

The forms *viroseanum* and *selendit* might respectively be regarded as small-leaved forms of f. *gutta* and f. *borneense*.

What is said about the shape and size of the leaf applies also to the tertiary nerves, the length of the petioles and that of the pedicels.

In the f. *gutta* transverse tertiary nerves are found but also nerves parallel to the secondary nerves, sometimes both types being represented side by side along the same branchlet. In this forma obovate leaves with the two different types of tertiary nervation are found but the same can be stated from the lanceolate leaves, sometimes even to such a degree that transverse and parallel tertiary nerves are found in one and the same leaf.

The small-leaved f. *viroseanum* has in general a parallel tertiary nervation but the same number of secondary ones as f. *gutta*. The difference in size and the transverse nervation, however, can not be regarded as characters sufficient to separate f. *viroseanum* from f. *gutta*.

In f. *borneense*, distinguished by usually obovate leaves, the same is found, though not to such an extent as in f. *gutta*, in the transverse and parallel tertiary nervation. Usually the tertiary nervation is transverse to the secondary nerves but nerves parallel to the latter are found in other specimens as well. The small-leaved f. *selendit* with a long petiole has transverse tertiary nerves and less secondary nerves but actually no sudden change in sizes, type of tertiary nervation and number of secondary nerves between this form *selendit* and f. *borneense* can be admitted.

What is said above induces rather the uniting of the forms distinguished by earlier authors than the separating of them.

82. P. tjipetirens H. J. Lam, l. c. 1925, 48, f. 7; Lam, l. c. 1927, 398; Lam, in Backer, Noodfl. Java, 7, 1948, Fam. 166, p. 10.

Trees, up to 25 m high. Branchlets irregularly angular, 3—5 mm in diam., ferruginously sericeous, glabrescent; terminal cone up to 10 mm long, sericeous; stipules lanceolate-linear, up to 2 by 0.5 mm, acute or acuminate at apex, sericeous on outside, glabrous within, caducous. *Leaves* subconferted towards tip of branchlets, obovate, elliptic or oblong, 10—19(—30) by 3.5—8(—11) cm, usually rounded at apex, sometimes short obtusely or acutely acuminate, acumen up to 7 mm long, base cuneate, decurrent along upper side of petiole; glabrous above except along midrib ferruginously tomentose, cinnamomous or brown appressedly tomentose below, subcoriaceous; midrib grooved above, rounded below, secondary nerves 13—17 pairs, ascending at an angle of 50°—60°, slightly curved, diminishing until in-

conspicuous near margin, minutely grooved above or prominulous, prominent below, tertiary nervation slender, transverse, prominulous on either side but sometimes inconspicuous above. Petioles 2—3.5 cm long, grooved above, rounded below, cinnamomous, brown or ferruginously appressedly tomentose. *Flowers* in (3—)6—10-flowered, axillary clusters, pedicels angular, 5—10 mm long, in fruit up to 18 mm long, ferruginously appressedly tomentose. *Sepals* lanceolate or ovate-oblong, 3.5—4.5 by 2.5—3 mm, subacute at apex, ferruginously tomentose on outside, glabrous on inside, inner 3 sepals usually smaller and more obtuse than the outer ones, with membranous, glabrous and fimbriate margins, recurved in fruit. *Corolla* 10—12 mm long, on outside ferruginously sericeous on the tube and base of lobes, otherwise glabrous, lobes ovate-oblong, 7—8 by 2—3 mm, acute at apex. *Stamens* 12, 7—10 mm long, filaments filiform, 6—8 mm long, glabrous, anthers ovoid, c. 3 mm long, acuminate at apex, ferruginously sericeous on either side, dehiscing extrorsely. *Ovary* ovoid-conoid, c. 1 by 1.5 mm, 6-celled, 6-lobed, ferruginously sericeous. Style filiform, 6-ribbed, 12—15 mm long, glabrous. *Fruits* obovoid or obpyriform, 3—3.5 by 1.6—2.3 cm, 1- or 2-seeded, pericarp fleshy, glabrous. Seeds fusiform or ellipsoid, 2.5—2.8 by 1.2—1.8 cm, obtuse at apex, acute at base, testa thin, cartilaginous, dark brown, nitidous, scar covering half the surface of the seed, greyish, dull, embryo exalbuminous, radicle not or hardly exsert.

Type specimen: *Bakhuizen v. d. Brink* 2660 in BO.

Ecology: Only found in cultivation and by Heyne supposed to be of hybrid origin.

Distribution: Java, cultivated.

JAVA. West Java, Preanger distr., Tjipetir, Tjibadak, alt. 600 m: *Bakhuizen v. d. Brink* 2666 (BO, L), tree 10—25 m, fl. brown; *Hortus Bogoriensis*, Tjikeumeuh section HB 56 (BO, L), fl.

83. *P. calophyllum* (Teysmann & Binnendijk) Pierre in Burek, Ann. Jard. bot. Btzig 5, 1886, 28; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 8; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 279; Lam, l.c. 1925, 52, incl. var. *typica* and var. *philippinense* H. J. Lam; Lam, l.c. 1927, 398 — *Isanandra calophylla* Teysmann & Binnendijk, Nat. Tijdschr. Ned.-Ind. 27, 1864, 35 — *Dichopsis calophylla* (T. & B.) Benthams & Hooker f., Gen. Pl. 2, 2, 1876, 658 — **Fig. 20.**

Trees, up to 15 m. Branchlets terete to angular and costate, 2—5 mm in diam., golden-coloured, ferruginously or greyish tomentose, glabrescent; terminal cone up to 7 mm long; stipules lanceolate-linear, up to 4 by 2 mm, acute, ferruginously or greyish tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, obovate, rarely elliptic, (7—)11—19 by (3.5—) 4.5—9 cm, apex obtuse, or obtusely or acutely acuminate, acumen up to 16 mm long, base cuneate, decurrent along adaxial side of petiole; glabrous above, golden-coloured, ferruginously, or greyish tomentose or sericeous below,

Fig. 20. *P. calophyllum*, a. branchlet with leaves and immature fruits; b. branchlet with mature fruits; c. tertiary nervation of leaf; d. flower; e. outer sepal, inside; f. part of corolla, outside, showing the sparse pubescence; g. seed; h. embryo (cotyledon, rad. radicle) (*Kostermans* 6668, except g. and h. *Kostermans* 6883, in d. only part of the stamens drawn).



chartaceous or coriaceous; midrib grooved above, prominent and rounded below, secondary nerves 10—12 pairs (in *Beccari* 2278 6 only), ascending at an angle of 40°—50°, straight, curved at their tips, diminishing until inconspicuous near the margin, tertiary nerves transverse, inconspicuous above, prominent below. Petioles 8—33 mm long, narrowly grooved above, greyish, ferruginously or golden-coloured tomentose, often thickened in the basal part. *Flowers* in 2—11-flowered, axillary clusters, pedicels angular, 1—2.5 cm long, ferruginously or golden-coloured tomentose, in fruit up to 3 cm long. *Sepals* triangular-ovate, 3—3.5 by 2.5—3 mm, indistinctly obtusely acuminate, densely ferruginously or golden-coloured tomentose on outside, sparsely so on inside mainly in the apical half. *Corolla* c. 6 mm long, on outside with a few ferruginous hairs in the middle-line of the lobes, extending downwards over the tube, lobes lanceolate, 2—4 by 1.5—2 mm, obtuse at apex, reflexed in anthesis. *Stamens* 12, 2.5—4.5 mm long, filaments subulate, 1.5—3 mm long, angular, glabrous, anthers sagittate-ovoid, 1.5—2 mm long, acute, sometimes bifid, dehiscing laterally, connective sparsely ferruginously tomentose on outside. *Ovary* conoid, c. 2 by 2 mm, gradually tapering into the style, ferruginously sericeous, 6-celled, irregularly 6-lobed. Style filiform, 7—10 mm long, ferruginously tomentose at base only, but scattered so up to the middle. *Fruits* depressedly globose, up to 2 by 2.5 cm, 1- or 2-seeded, pericarp woody, densely ferruginously tomentose. Seeds subglobose, laterally slightly compressed, 11—14 by 10—12 by 8—10 mm, obtuse at either end, testa blackish brown, thin, scar covering about a third of the surface of seed, greyish, embryo exalbuminous, radicle inferior, not exerted.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Singapore: gutta salualam; Borneo: guttah samalam, malaupedara, njato, n. djangkar, n. merah.

Ecology: Common tree of lowlands along rivers, up to 200 m altitude.

Distribution: Malaya, Borneo, Mindoro; doubtful from Celebes, Ternate, Batjan, and New Guinea.

MALAYA. Singapore, Botanical Garden: *Nur s.n.* (SING), fr. May; ibidem: *Desmukh s.n.* (SING), small tree, fl. May.

BORNEO. Sarawak, Mattang: *Beccari* 2614 (FI), fl. Sept.; ibidem: *Beccari* 2226 (FI, G, NY, S), fl. July; ibidem: *Beccari* 2278 (FI, G), fl. July; Lundu, Mt Gadin: *Clemens* & *Clemens* 22200 (BO), Oct.; ibidem: *Egon* 239 (SAR), fl. Sept.; ibidem: *Daud* & *Tachun* 36097 (KEP, SING), tree 5 m, fl. Sept.; Pangkalan Ampat: *Beccari* 2752 (FI), fr. Nov.; Mt Selang For. Res.: *Egon* 489 (SAR), fl. Sept.; Mt Semengoh For. Res.: *Egon* 239 (SAR), fl. March — Sandakan, Beaufort distr., Beaufort Hill, alt. 100 m: *Wood SAN* 16985 (A, BO, BRI, K, L, SAN), tree 12 m, fr. June; Sipitang, Ulu Mandalong, alt. 600 m: *Wood SAN* 16778 (A, BO, BRI, K, L, SING), tree 17 m, fr. Sept. — Indonesian Borneo, Loa Haur, W. of Samarinda, low ridge, alt. 40 m: *Kostermans* 6883 (BO, L), tree 15 m, fr. brown, May; Loa Djuanan, W. of Samarinda, sandy loam ridge, alt. 30 m: *Kostermans* 6668 (BO, L), tree 15 m, fl. June, fr. April; Hayup: *Winkler* 2441 (L), fr. June; E. Kutai, Rantau Bahan, alt. 18 m: *NIFS* bb 15242 (BO, L), fl. April; Muarah Teweh, Pepas, alt. 30 m: *NIFS* bb 28098 (BO, L, SING), May; ibidem: *NIFS* bb 28086 & 29680 (BO, L, SING), fl. May & Oct.; ibidem: *NIFS* bb 29707 (BO, L, SING), fl. & fr. Nov.; ibidem: *NIFS* bb 28090 (BO, L), May; Sangkulirang, alt. 17 m: *NIFS* bb 15191 (BO, L), April; Bangaya: *Wade s.n.* (SING), Tandjong Bangko region near mouth of Mahakam river, alt. 20 m, sandy soil, low ridge: *Kostermans* 7030 (BO, L), tree 15 m,

fl. & fr. May, common; Berau, Inaran: *NIFS* bb 12154 (BO), tree 18 m, Oct.; Tandjung Rodeb, Labanan: *NIFS* bb 11547 (BO, L), tree 24 m, June; without known locality: *Teysmann* 14606 (BO), fl.

MINDANAO. f. Merrill, l.c. 1923. Also: Surigao: *Leuterio & Mallong* 27109 (?), tree 15 m, fl., type specimen of var. *philippinense* H. J. Lam.

TERNATE. f. Lam, l.c. 1925, 52.

CELEBES. f. Lam, l.c. 1927, 398.

BATJAN. f. Lam, l.c. 1925, 52.

NEW GUINEA. f. Lam, l.c. 1925, 52. Most of the specimens mentioned by Lam represent *P. supfianum* Schlechter.

Remarks. In *Daud & Tachun* 36097 the angle between secondary nerves and midrib is c. 35° but the number of secondary nerves is the same as in the other specimens. In *Beccari* 2278 this angle is also c. 35° but there are only 6–10 pairs of secondary nerves.

84. *P. ferrugineum* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 11; Lam, l.c. 1925, 71; Lam, l.c. 1927, 402 — Fig. 21.

Large trees. Branchlets angular, 1.5–4.5 mm in diam., cinnamomous-brown tomentose when young, glabrescent; terminal cone up to 10 mm long, cinnamomous-brown tomentose; stipules lanceolate, up to 4 by 2 mm, apex acute, cinnamomous-brown on outside, glabrous on inside, caducous. Leaves scattered, elliptic, 6–10 by 2–4.5 cm, apex obtusely acuminate, acumen up to 8 mm long, base narrowly cuneate, decurrent along adaxial side of petiole; very sparsely cinnamomous-brown tomentose above, densely so below, coriaceous; midrib grooved above, prominent and rounded below, secondary nerves 11–14 pairs, ascending at an angle of 35° – 45° , slender, straight, but curved at their tips, diminishing until inconspicuous, near margin, grooved above and sometimes rather inconspicuous, prominent below, tertiary nerves transverse, inconspicuous on either side. Petioles (1–)2–3 cm long, very narrowly grooved above, brownish tomentose. Flowers in 2–6-flowered, axillary clusters on prominent warts, pedicels angular, 2–6 mm long, cinnamomous-brown tomentose. Outer sepals ovate, c. 2 by 1.5 mm, apex subacute, brownish tomentose on outside, glabrous on inside, fimbriate, inner sepals elliptic-ovate, slightly smaller than the outer ones, indumentum the same as that of the outer sepals, margins membranous. Corolla c. 6 mm long, glabrous on either side, except for a few hairs at the base of the alternipetalous stamens, lobes elliptic-lanceolate, c. 5 by 1.5 mm, apex obtuse or obtusely acuminate, glabrous, reflexed in anthesis. Stamens 12, the alternipetalous ones usually slightly shorter than the epipetalous, 3.5–4 mm, filaments filiform, 2.5–3.5 mm long, glabrous except for a few hairs at the base of the alternipetalous ones, anthers oblong-ovoid, 1.5–2 mm long, apex mucronate, sparsely ferruginously hairy, dehiscing laterally to subextrorsely. Ovary disciform, c. 1 by 1.5 mm, 6-celled, ferruginously tomentose. Style subulate, 6–7 mm long, glabrous, at apex with 6 lighter coloured stigmas. Fruits unknown.

Type specimen: *Beccari* 2283 in P.

Ecology: In lowland rainforests.

Distribution: Borneo.

BORNEO. Sarawak, near Mattang: *Beccari* 2283 (FI, G, P, S), fl. July, large tree with very abundant latex.

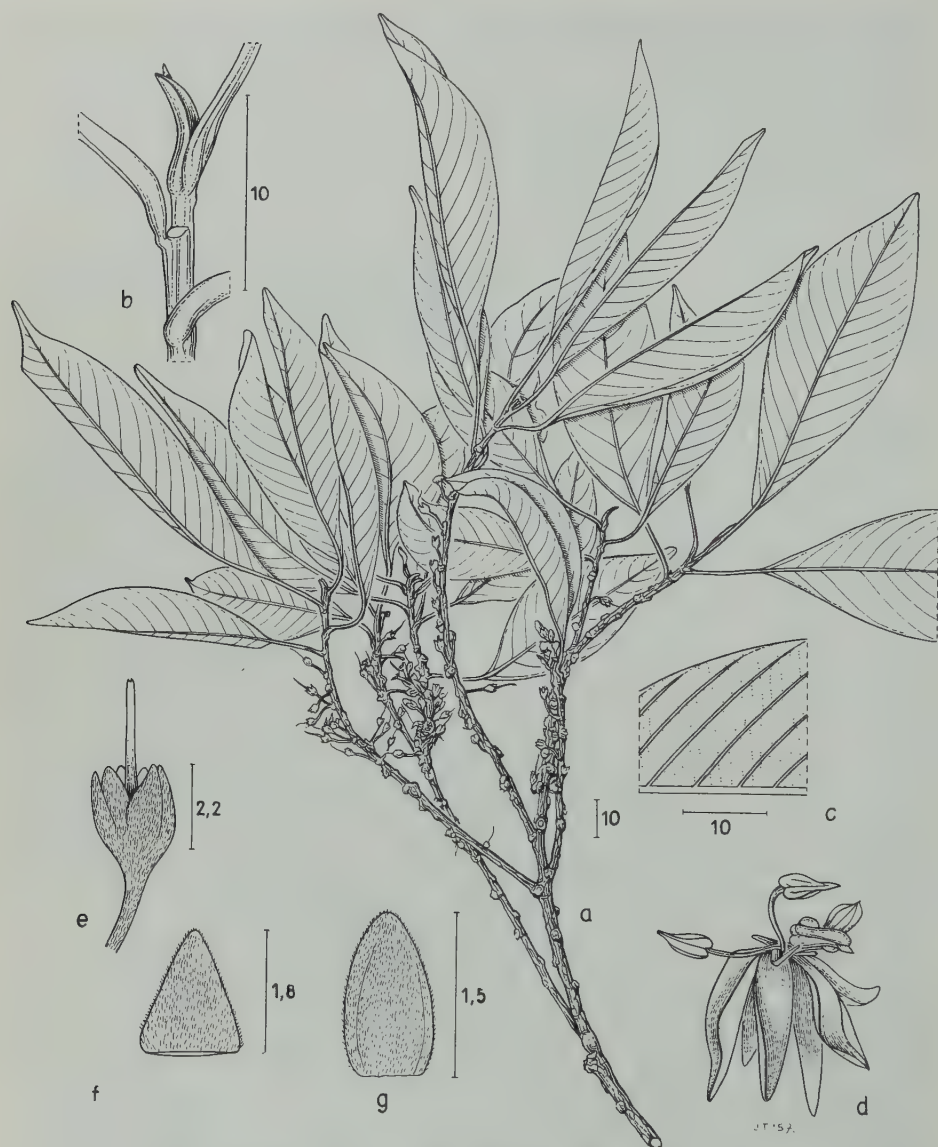


Fig. 21. *P. ferrugineum*, a. branchlet with leaves and flowers; b. top of branchlet; c. tertiary nervation of leaf; d. corolla with some stamens; e. calyx and gynaecium; f. outer sepal, outside; g. inner sepal, outside (*Beccari 2233*).

85. *P. quercifolium* (de Vriese) Burck, Ann. Jard. bot. Btzg 5, 1886, 41; Lam, l.c. 1925, 53; Lam, l.c. 1927, 399 — *Isonandra quercifolia* de Vriese, Nat. Tijdschr. Ned-Indië 21, 1860, 311 — *I. argentata* Teysmann & Binnendijk, Nat. Tijdschr. Ned-Indië 25, 1863, 415 — *Dichopsis argentata*

(T. & B.) Bentham & Hooker f., Gen. Pl. 2, 2, 1876, 658 — *Palauquium argentatum* Pierre in Burek, l. c., 1886, 30, t. 10 f. 1 & 2; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 4 — *P. macrophyllum* (de Vriese) Pierre ex Dubard, l. c. 9; Lam, l. c. 1925, 106; Lam, l. c. 1927, 413 — *Isonandra macrophylla* de Vriese, l. c., 309 — *Sideroxylon* ? *macrophyllum* Burek, Ann. Jard. Bot. Btzig 5, 1886, 20.

Trees, up to 40 m. Branchlets slender to stout, terete, 3–10 mm in diam., ferruginously tomentose, glabrescent; terminal cone 2–10 mm long, ferruginously tomentose; stipules lanceolate-linear, up to 11 mm long, acute, greyish or ferruginously sericeous on outside, glabrous on inside, caducous. *Leaves* scattered, obovate-oblong or narrowly elliptic, (8–)12–32 by (3.5–)5–10 cm, apex short acutely acuminate, very rarely rounded, base cuneate, slightly constricted before tapering along adaxial side of petiole, glabrous above, greyish, yellowish, brownish or reddish cinnamomous sericeous or puberulous below, thin-coriaceous; midrib grooved above, prominent and rounded below, secondary nerves 12–16(–19) pairs, ascending at an angle of 35°–45°(–60°), straight and curved at their tips, diminishing until inconspicuous near margins, sometimes archingly joined in the upper most nerves, prominulous and grooved above, prominent below, tertiary nerves transverse, slender, but less so below, prominulous on either side. Petioles (1.5–)3–7 cm, grooved above except in the basal third but thickened there, ferruginously tomentose, but ultimately glabrous. *Flowers* in 4–8-flowered, axillary clusters, pedicels 8–14 mm long, in fruit 1.5–2.4 cm long, ferruginously tomentose. *Sepals* lanceolate, 5–6 by 2–2.5 mm, acute, densely ferruginously tomentose on outside, sparsely so on inside. *Corolla* 12–16 mm long, outside ferruginously tomentose on the tube and less in the centre of the lobes, the latter ovate-lanceolate, 9–12 by 1.5–3.5 mm, apex subacute or obtuse and fimbriate, in fruit reflexed. *Stamens* 12, 10–12.5 mm long, filaments 7–9 mm long, glabrous, anthers ovoid-sagittate, 2.5–3.5 mm, acuminate at apex, glabrous. *Ovary* oboeoid to discoid, c. 0.7–1.5 mm, 5- or 6-lobed, 5- or 6-celled, ferruginously tomentose at apex only. Style filiform, 15–22 mm long, glabrous. *Fruits* globose, c. 2 cm in diam., glabrous (?), one-seeded, pericarp thin, woody. Seeds ellipsoid, c. 1.4 by 1.2 cm, yellowish brown, nitidous, testa thin, scar broadly elliptic or ovate, c. 1.2 by 1 cm large, grey, dull, cotyledons thick, exalbuminous, radicle punctiform, not exsert.

Type specimen: *Motley VII (1367)* in BO.

Vernacular names: Sumatra: *balam sago*; Borneo: *kerekit*, *malau*, *m. palung*, *nato palong*, *nyato*, *njatuh tinggang*.

Distribution: Sumatra, Borneo, Celebes, Batjan, Amboina.

SUMATRA. Central Sumatra, Indragiri, Taluk region, Dipterocarpaceae forest: *Meyer 4130* (L), Jan., doubtful specimen.

RIAUW. Lingga, Bukit Tandjung Sembilang, alt. 7 m: *NIFS bb 31654* (BO, L), Dec.

BORNEO. Brunei, Labi Rd, 17.5 mile, primary forest: *Ashton BRUN 34* (L), fl. buds May, tree 33 m — Sandakan, Kinabatangan distr., on hill at Kuala Daramakud: *Kadir bin Abdul SAN 16873* (L, SAN), tree c. 23 m, fl. May — Indonesian Borneo, Bandjermasin: *Motley VII (1367)* (BO, L); Pleihari, Kintap, alt. 150 m: *NIFS bb 13467* (BO, L), fl. Nov.; West Kutai, Sei Long Paka, alt. 50 m: *NIFS bb 24018* (A, BO, L), fl. March; ibidem: *NIFS bb 24019* (BO, L), March; Kendisi, alt. 90 m: *NIFS bb 16682* (BO, L), May; Mendom (Sei Klindjau), alt. 50 m: *NIFS bb 29239* (A, BO, L), Aug.; Kelumpang, alt. 30 m: *NIFS bb 16958*

(BO, L), May; Muara Teweh, Sei Ajoeh, Pepas, alt. 50 m: *NIFS* bb 29198 (BO, L); ibidem, alt. 25 m: *NIFS* bb 21213 (BO, L), June; Tanah Bumbu: *NIFS* bb 13081 (BO), tree 34 m, fr. Dec.; Tandjung Pangelak: *NIFS* bb 13964 (BO), tree 33 m, fr. Dec.; Balikpapan, Sungei Wain, alt. 80 m, primary forest: *NIFS* bb 34320 (BO, L), tree 24 m; E. Kutai, Sg Kerajaan (Sangkulirang), alt. 30 m, old primary forest: *NIFS* bb 34788 (BO, L), tree 23 m, July; Banjarmasin: *de Vriese* 1232 (L), type specimen of *Isonandra macrophylla* de Vriese.

CELEBES. Makassar: *Teysmann* s.n. (BO, L), fl. & fr.

BATJAN. without loc.: *Herb. Bog.* s.n. (NY).

AMBOINA. f. Lam, l.c. 1927, 53.

Dubious specimen:

Sandakan, Beaufort Hill, NE of Beaufort Township, alt. 110 m: *Wood* SAN 16917 (L, SAN), tree 20 m, fr. June.

This specimen is placed here but it differs from all other specimens in the glabrous underside of the leaves.

Remark. Contrary to earlier descriptions the inside of the calyx is pubescent and not glabrous.

86. *P. rigidum* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 18; Lam, l.c. 1925, 27; Lam, l.c. 1927, 387.

Trees? Branchlets terete, c. 6 mm in diam., brownish tomentose, glabrescent; terminal cone 2—4 mm long, greyish or brownish tomentose; stipules ovate, up to 2 by 2 mm, subacute or acute, greyish or brownish tomentose on outside, ferruginously tomentose on inside, caducous. *Leaves* subconferted at apex of branchlets, obovate, 14—22 by 6—8 cm, obtusely acuminate, acumen 2—4 mm long, base narrowly cuneate, decurrent; glabrous on either side, chartaceous; midrib impressed above, prominent and rounded below, secondary nerves 13—16 pairs, ascending at an angle of 60°—70°, slightly curved, diminishing until inconspicuous near margin, distinct on either side, tertiary nerves transverse but almost parallel to secondary nerves, few, with a distinct reticulate nervation in between, distinct on either side. Petioles (2—)2.5—4 cm long, flat above and slightly grooved in the apical part, greyish or ferruginously tomentose in the basal part. *Flowers* in 2—4-flowered, axillary clusters, pedicels angular, 12—17 mm long, ferruginously tomentose. *Sepals* ovate-lanceolate, 5—6.5 by 3.5—4.5 mm, apex obtuse, ferruginously tomentose on outside, glabrous on inside, ferruginously woolly fimbriate, inner sepals thinner than outer ones and with membranous margins. *Corolla* 8—10.5 mm long, glabrous on either side, lobes elliptic-oblong, 5.5—6.5 by 3.5—4.5 mm, apex obtuse. *Stamens* 12, in 2 whorls, (5.5—)7.5—8.5 mm long, filaments filiform, 2.5—4 mm long, glabrous, anthers oblong-lanceolate, 3—4 mm long, apiculate, glabrous, dehiscing extrorsely. *Ovary* disciform, c. 1 by 1.5 mm, 6-celled, 6-grooved, ferruginously tomentose, provided with a thin disk. Style filiform, 10—12 mm long, terete, infundibuliform at apex. *Fruits* unknown.

Type specimen: *Beccari* 2284 in FI.

Distribution: Borneo.

BORNEO. Sarawak, Mattang: *Beccari* 2284 (FI, G, L), fl. July.

87. *P. rubiginosum* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 9; Lam, l.c. 1925, 107; Lam, l.c. 1927, 414 — *Isonandra rubiginosa* Thwaites, Enum., 1864, 177 — *Dichopsis rubiginosa* (Thwaites) Bentham, Gen. Pl. 2, 1876, 658; Clarke

in Hooker f., Fl. Br. Ind. 3, 1882, 541 — *Bassia rubiginosa* (Thwaites) Beddome, Fl. Sylv. 2, 1869—1873, t. 254; Beddome, For. Man., 1871, 141.

Trees. Branchlets stout, terete, 6—11 mm in diam., reddish villose but soon glabrous; terminal cone broadly conoid, up to 3 mm long, villose; stipules lanceolate, up to 5 by 2 mm, obtuse at apex, puberulous on either side, caducous. *Leaves* conferted or subconferted near tips of branchlets, obovate-oblong, or spatulate, (5.5—)9—16 by (2.5—)3.5—6.5 cm, rounded, obtuse or indistinct obtusely acuminate at apex, narrowly cuneate at base, shortly decurrent; glabrous above, greyish, brownish or rusty tomentose below, coriaceous; midrib impressed and minutely grooved above, prominent and rounded below, secondary nerves 8—13 pairs, ascending at an angle of 40°—50°, straight, archingly joined near margin, prominent on either side, tertiary nerves few, reticulate, sometimes one nerve more distinctly developed and parallel to the secondary nerves, inconspicuous to distinct on either side. Petioles 8—17 mm long, prominulous, flat or slightly grooved above, often rugulose in the basal 2/3, with the same type of pubescence as the leaf. *Flowers* in 6—10-flowered, axillary clusters near apex of branchlets, pedicels angular, 1.5—3.5 cm long, in fruit up to 4.5 cm long, thickened at apex, brownish or greyish appressedly tomentose. *Sepals* lanceolate or ovate-lanceolate, 8—11 by 3—4 mm, acute at apex, ferruginously tomentose on either side, except for a narrow part in the middle-line on inside, inner sepals with glabrous, membranous margins, edge fimbriate. *Corolla* 8—10 mm long, glabrous on either side, but fimbriate at tip of lobes, lobes obovate-oblong, 6—7 by 3—3.5 mm, obtuse. *Stamens* 12, 5.5—6.5 mm long, filaments filiform, 3—4 mm long, in bud curved outwards and downwards but later stretching itself, glabrous, anthers sagittate-ovoid, c. 4 mm long, acutely cuspidate, glabrous, dehiscing laterally. *Ovary* ovoid-globose, c. 1.5 by 2 mm, 6-celled, glabrous. Style filiform, 9—11 mm long, glabrous. *Fruits* obovoid-ellipsoid, 2.7—3.5 by c. 2 cm, rounded, 1-seeded, pericarp crustaceous-fleshy, glabrous. Seeds subellipsoid, c. 2.3 by 1.3 cm, testa crustaceous, scar ovate, not reaching the tip of the seed, c. 4 mm broad, embryo exalbuminous.

Type specimen: *Thwaites* 394 in K.

Ecology: In forests at low altitudes.

Distribution: Ceylon.

CEYLON. Saffragam distr. and Hinidoon Corle: *Thwaites* 394 (BO, CAL, G, K, L, NY, US), fl. & fr.; ibidem: *Thwaites* 344? (CAL), fl.

88. **P. polyanthum** (Wallich) Baillon, Tr. Bot. Méd. Phan., 1884, 1500, Add.; Lam, l. c. 1927, 414 — *P. polyanthum* (Wallich) Engler, Bot. Jahrb. 12, 1890, 511; Lam, l. c. 1925, 107, 258; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 18 — *Bassia polyantha* Wallich, Cat., 1828, 4156; A. DC, Prodr. 8, 1844, 198 — *Isonandra polyantha* Kurz, For. Fl. Br. Burma 2, 1877, 119; Kurz, Journ. As. Soc. 1877, pt. 2, 230 — *Dichopsis polyantha* (Wallich) Benth, Gen. Pl. 2, 1876, 658; Clarke in Hooker f., Fl. Br. Ind. 3, 1882, 542 — *Sideroxylon regium* Wallich, Cat., 1828, 4156, p. p.

Trees, up to 15 m. Branchlets terete, 3—6 mm in diam., sparsely greyish puberulous, glabrescent; terminal cone up to 6 mm long, puberulous; stipules lanceolate, up to 7 by 2 mm, acute to aristulate, puberulous on

outside, glabrous on inside, caducous. *Leaves* scattered, sometimes clustered at apex of branchlets, oblanceolate, obovate or obovate-oblong, 12.5—20 (—35) by 4—8 (—12) cm, subobtuse or short obtusely acuminate at apex, acumen up to 4 mm long, cuneate or cuneate-rotundate at base, shortly decurrent; glabrous above, greyish yellow silky-tomentose below, but later sometimes subglabrous, coriaceous; midrib grooved above and minutely crested, prominent and rounded or angular below, secondary nerves 16—23 pairs, ascending at an angle of 80°—90°, slightly curved, archingly joined near margin, prominent on either side, sometimes grooved above, tertiary nerves laxly reticulate, sometimes a small number transverse, prominent on either side. Petioles 1—3.5 cm long, flat above, rounded below, thickened and rugulose in basal half or two-third, sparsely tomentose. *Flowers* in 7—10-flowered, axillary clusters towards the end of branchlets, pedicels terete or angular, 1.5—3 cm long, cinnamomously or greyish tomentose. *Sepals* elliptic-ovate, 5—6.5 by 4—5 mm, obtuse at apex, ferruginously, cinnamomously or greyish appressedly tomentose on outside, sparser so on inside, inner sepals usually broader and with membranous, fimbriate margins. *Corolla* 7—12 mm long, glabrous except for the ferruginously pilose throat, lobes elliptic, 3.5—6 by 1.5—2.5 mm, apex obtuse. *Stamens* 12 (—15), 5—6.5 mm long, filaments filiform, 3.5—4.5 mm long, with long brown hairs mainly in the basal part, anthers compressedly oblong, 2—2.5 mm long, rounded and mucronate at apex, glabrous, dehiscing laterally. *Ovary* broadly ovoid, c. 1 by 2.5 mm, 6-celled, 6-lobed, whitish pilose. Style filiform, 6—9 mm long, glabrous. *Fruits* not seen but according to Clarke: "a berry, 1.5 inch, obovoid, sealy brown, 1-seeded". Pedicel at apex thickened in fruit, up to 6 mm long.

Type specimen: *Wallich 4166* in K.

Use: Yields a good gutta-percha in large quantity.

Vernacular names: kurta, kherual, bonthai pionbuphang, kerbal, dieng-horua, salua (Assam).

Ecology: In forests at low altitudes.

Distribution: East Pakistan, India and Burma.

EAST PAKISTAN. Silhet: *Wallich 4166* (CAL, G, K), fl.; ibidem: *Hooker & Thomson s.n.* (CAL, K, L), sterile; Chittagong, Demagiri East: *Lister 221* (CAL, K), fl. March; Kisalong East: *Lister s.n.* (CAL, K), fl.; Luckipoor, alt. 100 m: *Clarke 42399* (C, CAL, K), tree 13 m, fr. Dec.; Cachar, Jelinga Tulak jungle: *Keenan s.n.* (K), fl. & fr., Sept.

INDIA. Assam, Silchari: *Mann s.n.* (CAL), fl. July.

BURMA. Pegu: *Wallich 4156* (K); Thaungzin div., Sw Ka Li Chg: *Maung Ba Pe 12903* (K), tree 15 m, fr. deep yellow, Dec.

Dubious specimens. *Gamble 6769 A* (CAL), from Pharoka, Chittagong, sterile, Febr.; *Kurz s.s.* (CAL, L), from Arracan, Boronga Island, on Mingoo Hill, 240—300 m, sterile, Oct.

89. *P. pauciflorum* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511; Trimen, Fl. Ceylon 3, 1895, 85; Lam, l.c. 1925, 107, 258; Lam, l.c. 1927, 414; King & Alston, Ann. Roy. Bot. Gard. Peradeniya 9, 3, 1930, 296 — *Isonandra pauciflora* Thwaites, Enum., 1864, 177 — *Bassia pauciflora* (Thwaites) Beddome, For. Man., 1870, 141 — *Dichopsis pauciflora* (Thwaites) Clarke in Hook. f., Fl. Brit. Ind. 3, 1882, 541 — **Fig. 22.**

Medium-sized trees. Branchlets terete, c. 3 mm in diam., brownish

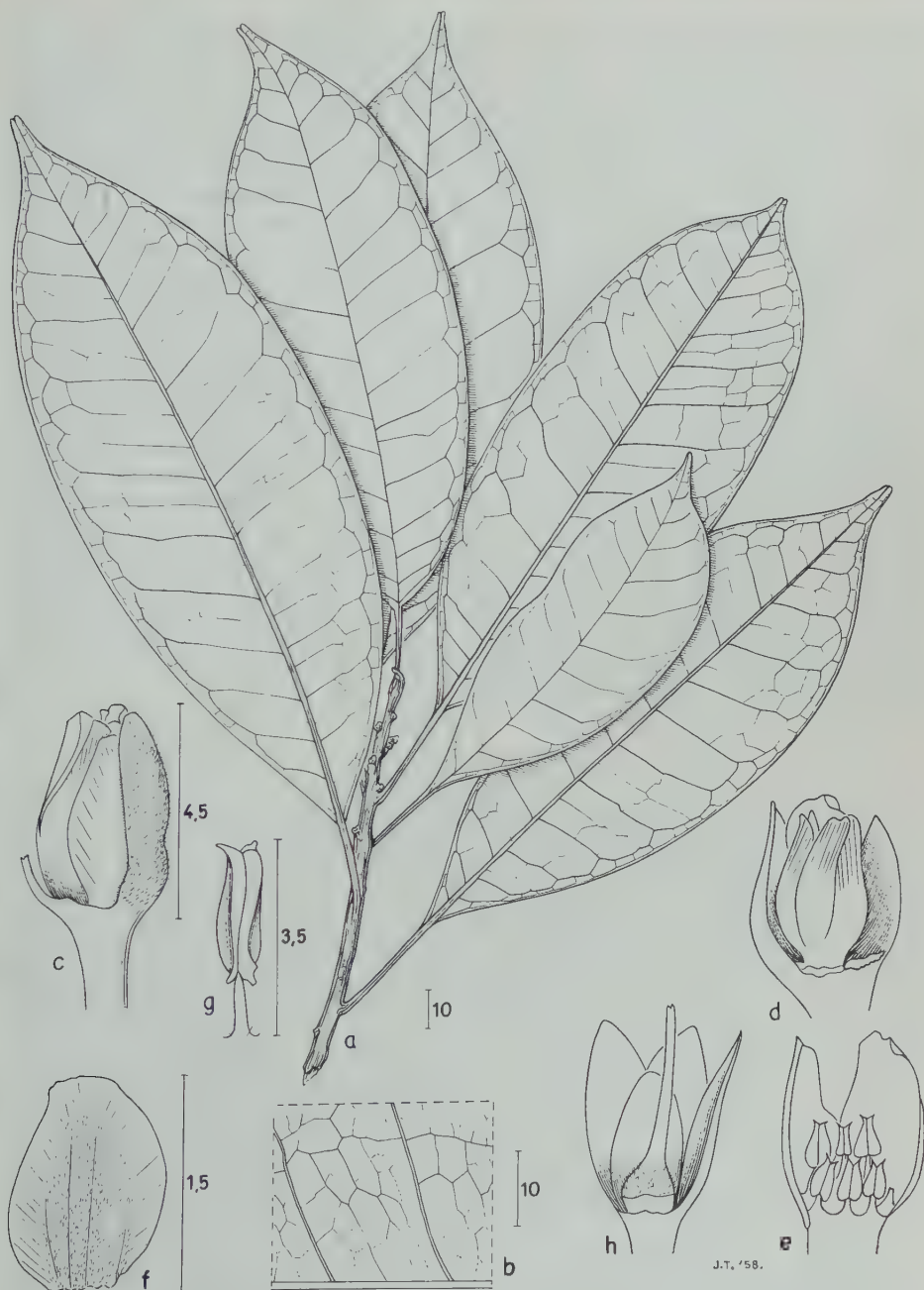


Fig. 22. *P. pauciflorum*, a. branchlet with leaves; b. tertiary nervation of leaf; c. flowerbud, part of calyx removed; d. flowerbud, part of calyx removed, showing the corolla; e. inner sepal, outside; f. stamen; g. part of corolla, with gynaecium (Thwaites 2680).

tomentose; stipules lanceolate, c. 1.5 by 1 mm, apex acute, tomentose on outside, glabrous on inside, caducous. *Leaves* scattered, ovate-elliptic, elliptic, or obovate-elliptic, 12—24 by 3.5—7.5 cm, apex long obtusely acuminate, acumen up to 2.5 cm long, base narrowly cuneate, decurrent along adaxial side of petiole; glabrous on either side, chartaceous, midrib grooved above, prominent and rounded below, secondary nerves 11—16 pairs, ascending at an angle of 75°—80°, straight or slightly curved, archingly joined rather far from the margin of the leaf, prominulous above, prominent below, tertiary nerves reticulate but usually one or two very irregular nerves between two nerves apparently transverse, inconspicuous above, distinct below. Petioles 10—26 mm long, grooved above, rounded below, thickened in basal part, glabrous. *Flowers* solitary or 2 together, axillary, pedicels angular, 1—2 mm long, ferruginously tomentose. *Sepals* ovate or elliptic, 3.5—4 by 2.5—3 mm, subobtusate at apex, densely ferruginously tomentose on outside, glabrous on inside, inner sepals truncate, rounded at apex, margins membranous and glabrous. *Corolla* seen in bud only, c. 3.5 mm long, entirely glabrous, lobes lanceolate, c. 2.5 by 1 mm, rounded or subtruncate at apex. *Stamens* 12, in 2 distinct whorls, the inner ones smaller than outer ones, almost entirely glabrous, 1—1.5 mm long, filaments linear-subulate, c. 0.5 mm long, with a few hairs at the base, anthers ovoid-ellipsoid or ovoid, 1—1.5 mm long, apex rounded with 2 mucros, dehiscing laterally. *Ovary* ovoid, c. 1 by 1 mm, 6-celled, ferruginously tomentose, but glabrous in the basal part. Style filiform, c. 3.5 mm long, glabrous. *Fruits* not seen but according to Clarke a berry and oblong.

Type specimen: *Thwaites* 2680 in K.

Distribution: Ceylon.

CEYLON, near Ratnapura: *Thwaites* 2680 (CAL, G, K), fl.

90. ***P. rostratum*** (Miquel) Burek, Ann. Jard. bot. Botz 5, 1886, 39; Heyne, Nutt. Pl. Ned. Ind., ed. 1, 4, 1917, 24; Lam, l. c. 1925, 40, 254; Heyne, l. c., ed. 2, 2, 1927, 1239; Lam, l. c. 1927, 396; Lam, in Backer, Noodfl. Java 7, 1948, Fam. 166, p. 10; Heyne, l. c., ed. 3, 1, 1950, 1239; Wyatt-Smith, Research Pamphlet 4, 1954, 41 — ? *Isonandra rostrata* Miquel, Fl. Ind. Bat., Suppl., 1860, 581 — *P. verstegei* Burek, l. c. 35; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 18; Heyne, l. c. 1917, 25; Hallier, Rec. Trav. bot. néerl. 15, 1918, 71 — *P. bancanum* Burek, l. c. 43; King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr. 17, 1905, 195; Heyne, l. c. 1917, 17; Ridley, Fl. Mal. Pen. 2, 1923, 275 — ? *P. linggense* Burek, l. c. 42 — *P. membranaceum* Burek, l. c. 42, non 43 — *P. parviflorum* Burek, l. c. 37 — *P. parvifolium* Burek, l. c. 36 — *P. laeve* Ridley in msc.

Trees, up to 60 m high. Branchlets terete but at apex sometimes angular, 2—8 mm in diam., brownish, ferruginous or greyish puberulous but soon glabrous; terminal cone up to 5 mm long, brownish, ferruginous or blackish pubescent; stipules lanceolate, c. 1 by 0.5 mm, apex acute, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered or subconferted at apex of branchlets, obovate, spatulate or elliptic, (5—)7—22 by 2.5—7(—9) cm, apex retuse, rounded, obtuse, short obtusely acuminate or obtusely cuspidate, acumen up to 15 mm long, base narrowly cuneate, decurrent; glabrous on either side, subcoriaceous or chartaceous, sometimes

membranous; midrib flat or slightly grooved above and sometimes minutely crested, prominent and angular below, secondary nerves 15—28 pairs, ascending at an angle of 70° — 90° , but c. 40° at apex, straight, but curved at their tips, irregularly archingly joined near margins, prominulous on either side and sometimes hardly separable from the tertiary nervation, the latter reticulate-parallel to secondary nerves but sometimes a few nerves transverse though almost parallel to the secondary nerves as well, prominulous on either side. Petioles 10—32 mm long, flat above and crested, angular below, glabrous. *Flowers* solitary or in 2—5-flowered, axillary clusters, almost sessile, pedicels angular, 0.5—3(—12) mm long, in fruit thickened, ferruginously tomentose. *Sepals* ovate, 1.5—3 by 1—2 mm, apex obtuse, ferruginously tomentose on outside, glabrous on inside, the inner ones with membranous and fimbriate margin, in fruit slightly reflexed. *Corolla* 2.5—3.5 mm long, reflexed in anthesis, sparsely ferruginously sericeous on outside in the basal parts of the lobes, but soon becoming glabrous, and ferruginously woolly in the throat, lobes oblong-ovate, 2—2.5 by 1—1.5 mm, apex obtuse, margin membranous. *Stamens* 12, 1.5—2.5 mm long, the oppositipetalous ones longer than the alternipetalous, filaments subulate, 0.5—0.7 mm long, ferruginously woolly, but sometimes soon glabrous, anthers ovoid, flattened, 0.7—1 mm long, apex mucronate, glabrous. *Ovary* disciform, c. 0.5 by 1.5 mm, 6-celled, 12-lobed, ferruginously hirsute, style conoid, 1.5—3.5 mm long, glabrous. *Fruits* ovoid-ellipsoid or ellipsoid, (1.5—)2—3.5 by (0.8—)1.2—1.6 cm, 1-seeded, apex rounded, often with a short remnant of the style, pericarp fleshy, glabrous, seeds obovoid, 1—2.3 by 0.6—0.9 cm, apex obtuse, base obtusely acuminate, testa thin, brown, glossy, scar covering about half of the seed, greyish, dull, albumen none, radicle small, exsert.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Siam: pikul pah; Johore: nyatoh semaram; Malacca: nyatoh bunga tanjing; Perak: nyatoh bunga, n. sidang; Selangor: malang, nyatoh; Singapore: nyatoh bukit; Billiton: njatuh merah, n. pisang, n. t̃erung; Banka: njatoah darat, n. pisang, n. terun; Sumatra: balam bakal, b. dulang, n. katijau, b. perak, b. pulan, b. putat, b. putjung, b. sudu, b. t̃emigih, b. terung, meranti busuk, njatoh bungo tandjong, n. terung, pulau pipit, wajang raja; Java: ki bangkong, nagasari; Borneo: njatoh baian, n. baitis, n. hawin gunung, n. geronong, n. kalalang, n. kl̃ew̃r; Amboina: siekie.

Use: The fruits are edible and from the seeds an edible fat is extracted in Bangka and Billiton. In some parts of Borneo (Sandakan) the wood is used for building purposes.

Ecology: This tree usually grows in swampy primary forests at low altitudes.

Distribution: Siam, Malaya, Sumatra, Lingga, Riouw, Banka, Billiton, Siberut, Borneo, Java, Celebes, Amboina.

SIAM. Kopah Ban Kiap: *Haniff & Nur 2726* (SING), tree c. 20 m, fl. Dec.

MALAYA. Kedah, Perangin For. Res.: *Awang 47332* (KEP), tree, Aug. — Penang, Government Hill, alt. 600 m: *Curtis s.n.* (SING), fl. Oct. — Trengganu, Dungun distr., Br. Bank For. Res., alt. 50 m: *Ahmad bin Ibrahim 53357* (KEP), tree 60 m, Sept. — Perak, Kroh For. Res.: *Symington 31048* (KEP), tree 16 m, June; Pulau Tanjung For. Res.: *KEP 63468 & 65562* (KEP), tree 18 m, Aug. — Pahang.

Kuantan, Bukit Goh Res.: *Sohor 8144* (SING), fl., imm. fr., Nov.; Balok For. Res.: *Arip 17201* (KEP), tree 20 m, fr. Jan.; ibidem: *Debah 17218* (KEP), tree 16 m, juv. fr., July; ibidem: *KEP 17209* (KEP), tree 16 m, juv. fr., July; ibidem: *Arip 6847, 6848 & 6849* (KEP), tree 20 m, fr. Jan.; Sungei Parang: *Symington 36272* (KEP), large buttressed tree, April; ibidem: *KEP 27195* (KEP), tree 20 m, Aug.; Mangtigi For. Res., Cameron Highland: *KEP 34118* (KEP), tree 22 m, Sept.; ibidem: *KEP 34131* (KEP), tree 35 m, Sept. — Selangor, state land near Telok Res., Klang: *Walton 27068* (KEP), tree, Oct.; Port Dickson, Sg Mengala For. Res.: *Wyatt-Smith 66589* (KEP), seedling, Oct. — Negri Sembilan, Senaling Inas: *Symington 43542* (KEP), tree, fl. March; Pasir Pandjang For. Res.: *Foston 18876* (KEP), tree 45 m, Nov. — Malacca, Merlimau For. Res.: *Ahmad 25342* (KEP), tree 35 m, fl. Dec.; ibidem: *Merlimau 50151 & 50152* (KEP), tree 52 m, fl. Febr.; Kepong: *Abdula Hamid 37579* (KEP), tree 5 m, Oct.; Jasin distr., Sedanan For. Res.: *Johan 62907* (KEP), tree 32 m, fl. March; Alor Gajah: *KEP 43864* (KEP), tree, fr. Aug. — Johore, Malan Res.: *KEP 69966* (KEP), tree 30 m, Jan.; Mersing, Mt Arong For. Res.: *KEP 70234* (KEP), tree 45 m, Aug. — Singapore, Bukit Timah: *Alvius 11307* (SING); ibidem: *Ngadiman 34538* (A, BO, SING), fr. Nov.; ibidem: *native collector 6134* (SING), fl.; Mandai Rd, in swampy forest: *Corner 37117* (BO, KEP, SING), tree, fl. fr. July; Kranji: *native collector 5689* (SING), tree; Botanic Gardens, near Store: *Nur s.n.* (A, BO, SING), tree 18 m, fr. Aug.; ibidem: *Ridley 6507* (SING), fr.; ibidem: *Ridley 1660* (SING), tree 26 m, fr. June, lvs with scent of mice; rockery in garden: *Ridley 6019* (SING), fl. Oct.; ibidem: *Furtado s.n.* (SING), tree 20 m, fl. Sept.

RIOUW. Kwantan distr., Muara Pantei, alt. 100 m: *NIFS bb 23851* (A, BO, L, SING), Febr.; Kuala Sungei, Sembilang, alt. 15 m: *NIFS bb 31656* (BO, L, SING), Dec.

SUMATRA. Palembang, Lematang Ilir, Semangoes, alt. 100 m: *NIFS bb 32227* (BO, L), July; Musi Ilir, Mangsang: *NIFS bb 18656* (BO), tree 26 m, Aug.; without loc.: *Burek s.n.* (BO, L) *type specimen of Palaquium membranaceum* Burek; ibidem, Diepenhorst s.n. (BO, L), *type specimen of P. parviflorum* Burek; Djambi, Muara Pidjua: *NIFS bb 13172* (BO), tree 27 m, Dec.

LINGGA. f. Lam, l.e. 1925; without loc.: *Teysmann s.n.* (BO, L), *type of Palaquium linggense* Burek.

BANKA. Lobok Besar, sandy soil, alt. 200 m: *Anta 1104* (A, BO, K, L, SING), tree 25 m, fl. brown, Oct., buds brown-green; ibidem, alt. 10 m: *Anta 390* (BO, L, SING), tree 40 m, fl. dirty yellow, Sept.; ibidem: *Kostermans 219* (BO, L, SING), tree 15 m, fl. brown, Oct.; Mt Mangkol, alt. c. 50 m, primary forest on granite: *Anta 688* (BO, L, SING), tree 30 m, fl. brown, Sept.; ibidem, alt. 5 m: *NIFS bb 33985* (BO, L, SING), tree 28 m, fl. white, very sweet scented, Sept.; ibidem, alt. 100 m: *Kostermans 103 A* (BO, L), tree 32 m, fl. buds, Sept.; without loc.: *Teysmann s.n.* (BO, L), *type specimen of Palaquium verstegei* Burek; ibidem: *Teysmann s.n.* (BO, L), *type specimen of Palaquium parvifolium* Burek; ibidem: *Teysmann s.n.* (BO, L), *type specimen of Palaquium bancanum* Burek; near Djebus: *Teysmann s.n.* (BO, L), *type specimen of Isonandra rostrata* Miquel.

BELLITON. Sloping country, forest on sandy soil, alt. 25 m: *NIFS bb 33713* (BO, L), tree; Tandjung Pandang: *NIFS bb 14730* (BO), tree 40 m, Oct.; ibidem: *NIFS bb 14734* (BO), tree 27 m, Oct.

SIBERUT. Kotorai: *NIFS bb 17446* (BO), tree 17 m, Sept.

BORNEO. Sarawak, Mattang: *Baccari 3013* (FI), tree, Dec.; ibidem: *Egon 583* (SAR), tree, fr., Febr.; Loba Katang South P. F., swamp forest: *Anderson 50585* (FHO), tree; ibidem, in mixed swamp forest: *Anderson 50527* (FHO), tree, Febr.; Kuching: *Broune 1150* (SAR), fr. Oct.; ibidem: *Tinggi 1182* (SAR), Febr.; ibidem: *Haviland 3034* (BM, K, SING), fl. May; ibidem: *Haviland 3036* (BM, K), fl. May; Brunei, Labuan: *Symington 35433* (KEP), tree, fr. July; ibidem: *Cuadra A 3063* (SING), tree, March; Sandakan, Pababak Island, Forest Reserve near Serporna: *Cuadra A 2457* (SING), tree 16 m, Oct.; Kuala Penyu, Mempakul, alt. 3 m: *Tandon 4205* (K, L), tree 13 m, fl. white, Nov.; Marotai, alt. 3 m: *Maidin 3658* (K, L), tree 30 m, fl. olive green, Sept.; Jesselton Interior distr., Kiamnis: *Cuadra A 1375* (KEP, SING), tree 16 m, April; Lumanggas Island, Lahud Datu: *Harvey A 114* (SING), tree, fr. May; Sepilok For. Res.: *Wood SAN A 3867* (A, BRI, K, KEP, L, SING), Febr.; Beaufort Hill, alt. 100 m: *Wood & Sisron SAN A 16833* (A, K, L, SING),

tree 17 m, fr. Aug.; Sipitang, Uluu Mendalong, alt. 80 m: *SAN 16786* (A, K, L, SAN), tree 50 m, fr. Sept. — Indonesian Borneo, Sg Bambangan, SE of Samarinda: *Kostermans 6098* (BO, L), tree 35 m, fl. & fr. Aug.; ibidem: *Kostermans 6107* (BO, L), tree 20 m, fr. green, Aug.; Nunukan Island, near seacoast: *Kostermans 9236* (BO, L), tree 30 m, Jan.; Loa Djanan, W of Samarinda, low sandy loamsoil, alt. 30 m: *Kostermans 6427, 6429* (BO, L), tree 40 m, imm. fr. green; ibidem, alt. 30 m: *Kostermans 6436* (BO, L), tree 35 m, buttresses 1 m high, fl. dirty yellowish, April; E. Kutai, Sei Bai: *NIFS bb 14880* (BO), tree, fr. Dec.; ibidem, Pengnaan: *NIFS bb 14849* (BO), tree 30 m, Dec.; ibidem, Tapian Leban: *NIFS bb 14645* (BO), tree 32 m; W. Kutai, Kembang: *NIFS bb 15619* (BO, L, SING), tree, juv. fr., Sept.; ibidem: *NIFS bb 15640* (BO, L), tree, fr. Sept.; Puruk Tjahu Tahundjan, alt. 75 m: *NIFS bb 21188* (A, BO, L, SING), tree, July; Tandjong Bangko region near mouth of Mahakam river, alt. 20 m, sandy soil on low ridge: *Kostermans 7021* (BO, L), tree 25 m, fr. green, May; ibidem: *Kostermans 7131* (BO, L), tree 20 m, fr. June; Tidung Lands, Sibenggaris: *NIFS bb 20020* (A, BO, L, SING), tree, fr. July; ibidem, Bahnnon, alt. 7 m: *NIFS bb 17785* (BO, L), tree, July; Tandjung Merah: *NIFS bb 18339* (BO), tree 28 m, Nov.

JAVA. Western Java, Bogor, Dungus Iwul, Tjigelung: *NIFS Ja 4536* (BO), tree 35 m, April. See also Lam, l.c. 1925.

CELEBES. Manado, Amurang Lobak Kolai, alt. 270 m: *NIFS bb 17130* (BO, L), Sept.; Boné, alt. 25 m: *NIFS bb 21710* (BO, L), Dec.

AMBOINA. Waai, primary forest, alt. c. 30 m: *Buwalda 6158* (BO), fl. buds yellow, Sept.

91. *P. canaliculatum* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 18; Lam, l.c. 1927, 107, 258; Lam, l.c. 1927, 414 — *Isonandra canaliculata* Thwaites, Enum., 1864, 177 — *Dichopsis canaliculata* (Thwaites) Clarke in Hooker f., Fl. Br. India 3, 1882, 541; Bentham & Hooker f., Gen. Pl. 2, 2, 1876, 658 — *Bassia canaliculata* (Thwaites) Beddome, For. Man., 1870, 141.

Medium-sized trees. Branchlets terete or angular, 2—4 mm in diam., ferruginously puberulous, glabrescent; terminal cone up to 5 mm long, puberulous; stipules lanceolate, c. 1.5 by 1 mm, acute, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered, elliptic-oblong, or elliptic, 9—13 by 2.5—5.5 cm, apex rounded and shortly obtusely acuminate, acumen up to 3 mm long, cuneate at base or rounded, decurrent along adaxial side of petiole; entirely glabrous but sometimes midrib slightly pubescent below, subcoriaceous; midrib narrowly grooved above, rounded and prominent below, secondary nerves 13—17 pairs, ascending at an angle of c. 70°, slightly curved or straight and curved at their tips only, irregularly archingly joined rather far from the margin, with a thin intramarginal nerve, prominulous above, prominent below, tertiary nerves reticulate, with one or a few irregular transverse nerves, inconspicuous above, prominent below. Petioles 1.5—2.4 cm, narrowly grooved above, rounded below, thickened and coarse in the basal part, glabrous. *Flowers* solitary, or in 2—6-flowered, axillary clusters, pedicel angular, 1.2—2.6 cm long, thickened near apex, cinnamomously puberulous. *Sepals* ovate, 6—8 by 4—6 mm, subacute at apex, cinnamomously puberulous on outside, glabrous on inside, inner sepals with glabrous, membranous and fimbriate margin. *Corolla* and *stamens* unknown. *Ovary* disciform, c. 1 by 2.5 mm, 6-lobed, ferruginously puberulous, at base surrounded by an annular ferruginously puberulous disk. Style filiform, 9—12 mm long, glabrous. *Fruits* obovoid, c. 1.8 by 1.6 by 1 cm, 1-seeded, pericarp thin, glabrous except for a few ferruginous hairs at base of fruit. Seeds same shape as fruit, laterally compressed,

13 by 7 by 3 mm, obtuse at apex, subobtuse at base, testa light brown, scar covering half of the seed, greyish, exalbuminous, radicle inconspicuous.

Lectotype specimen: *Thwaites 3473* in K.

Distribution: Ceylon.

CEYLON. Cultura: *Thwaites 3473* (CAL, G, K), fl. & fr.; without loc.: *Thwaites 3436* (K); ibidem: *Walker 115* (K), fl.

92. *P. bourdillonii* Brandis, Indian Trees, 1906, 424; Gamble, Fl. Madras 4, 1921, 765; Lam, l. c. 1925, 258 — **Fig. 23.**

Small trees. Branchlets terete, 2—3 mm in diam., ferruginously tomentose at apex only; terminal cone c. 2 mm long, ferruginously tomentose; stipules lanceolate, c. 1 by 0.5 mm, acute, tomentose on outside, glabrous on inside, soon caducous. *Leaves* conferted at apex of branchlets, subopposite or in indistinct whorls, obovate-elliptic or elliptic, 11—17.5 by 3.5—6 cm, apex obtusely acuminate to subcuspidate, acumen up to 15 mm long, base narrowly cuneate; glabrous above but finely scattered puberulous along the midrib, sparsely puberulous below, membranous; midrib flat and prominulous above, rounded and prominent below, secondary nerves 10—12 pairs, ascending at an angle of c. 50°, curved, archingly joined or connected by some thickened tertiary nerves, prominulous above but distinct, prominent below, tertiary nerves widely reticulate, distinct on either side but more prominent below than above. Petioles 5—15 mm long, flat above, angular below, thickened in the basal part, ferruginously tomentose. *Flowers* solitary or in 2-flowered, axillary clusters, pedicels terete, c. 10 mm long, ferruginously woolly, in fruit up to 22 mm long. *Sepals* ovate, 5—7 by 3—4 mm, apex subacute, ferruginously woolly-tomentose on outside, ferruginously on inside in the apical part only, glabrous in the basal part, inner sepals with membranous and fimbriate margin. *Corolla* 5.5—6 mm long, seen in bud only, glabrous on either side, lobes spatulate-oblong, 3.5—4 by c. 1.5 mm, obtuse or subtruncate at apex. *Stamens* 12, 2.5—3 mm long, filaments c. 1.5 mm long, densely pale yellowish hairy on inside, anthers compressedly ovoid, 2—2.5 mm long, apex bifid, dehiscing laterally, glabrous. *Ovary* ovoid, c. 1.5 by 1.5 mm, 6-celled, 6-lobed, brownish hirsute. Style filiform, c. 5 mm long, glabrous. *Fruits* ovoid, c. 3 by 1.3 cm, subacute at apex, glabrous, 1-seeded; complete seeds unknown.

Type specimen: *Bourdillon 609* in CAL.

Ecology: In evergreen forests up to 1300 m altitude.

Distribution: India.

INDIA. Madras, Strathmore Patenas, alt. c. 1300 m: *Bourdillon 609* & *610* (CAL, K), fl. buds, April; Travancore, Tinnavalley ghats: *Beddome 4868* (SING), fr.

Remark. The fruits have have been described after *Beddome 4868*.

93. *P. hinmolpedda* van Royen, nom. nov. — *Dichopsis grandis* (Thwaites) Clarke, var. *parvifolia* Clarke in Hooker f., Fl. Br. Ind. 3, 1882, 540 — *P. grande* (Thwaites) Engler, var. *parvifolium* (Clarke) King & Alston, Ann. Roy. Bot. Garden, Peradeniya 11, 3, 1930, 294, pl. 40 f. 2, 3.

Trees. Branchlets terete, 2—3.5 mm in diam., pale ferruginously tomentose, glabrescent; terminal cone narrowly conoid, up to 4 by 2 mm, tomentose; stipules lanceolate, up to 2 by 1 mm, acute, tomentose on out-

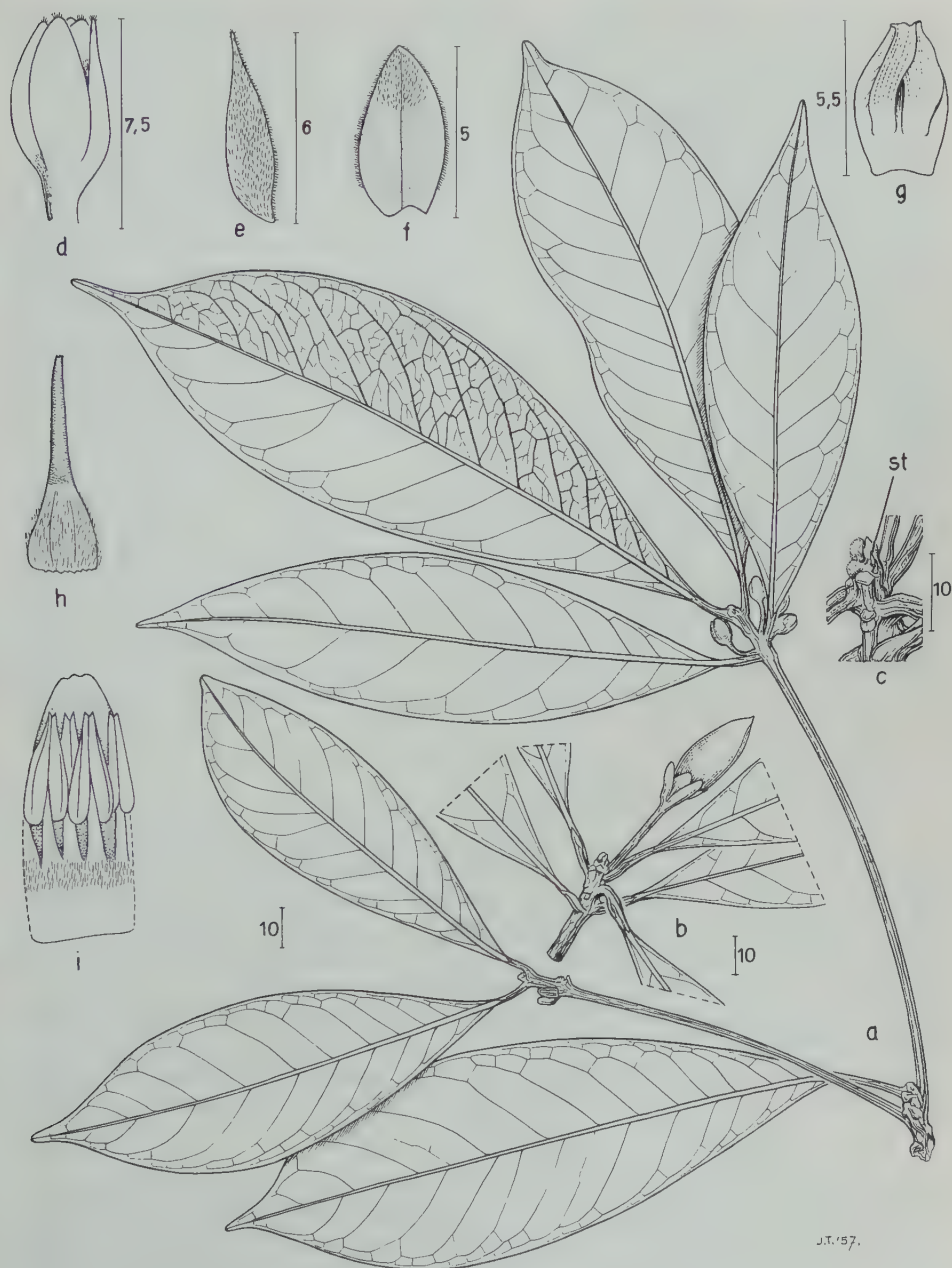


Fig. 23. *P. bourdillonii*, a. branchlet with leaves and flowerbuds; b. fruit; c. apex of branchlets showing stipules (st); d. flowerbud; e. inner sepal, from aside; f. inner sepal, inside; g. corolla, in bud; h. gynaecium; i. part of corolla and androecium (Bourdillon 609).

side, glabrous on inside, soon caducous. *Leaves* conferted near apex of branchlets, spathulate or obovate, 4—8 by 3—4.5 cm, apex rounded, obtuse or indistinctly obtusely acuminate, base cuneate; glabrous on either side, juvenile leaves sometimes with scattered pale hairs above and more so at the base, but finally glabrous, coriaceous; midrib flat above, prominent below, secondary nerves 7—10 pairs, ascending at an angle of 65°—80°, straight or curved, archingly joined, inconspicuous above, prominent below, tertiary nerves widely reticulate, inconspicuous above, prominent below. Petioles 8—11 mm long, flat above, rounded below, rugulose, glabrous. *Flowers* in 2- or 3-flowered, axillary clusters, pedicels angular, 8—15 mm long, greyish or pale cinnamomous sericeous-tomentose. *Sepals* elliptic-oblong or lanceolate, 5—7 by 3.5—4.5 mm, rounded, obtuse or subacute at apex, greyish or pale ferruginously sericeous-tomentose on outside, either glabrous on inside or ferruginously tomentose or woolly along the margins, inner sepals with fimbriate margins. *Corolla* 6.5—8 mm long, glabrous except for a plumule of brown hairs at apex of lobes and between the bases of stamens, lobes elliptic-spathulate, 4.5—6 by 2—3 mm, truncate at apex. *Stamens* 12, the epipetalous longer than the alternipetalous and slightly lower inserted, the former 4—4.5 mm long, the latter 4.5—5 mm long, filaments either 2.5—3 or 3—3.5 mm long, anthers oblong, c. 2.5 mm long, apex acute or subbifid, glabrous, dehiscing extrorsely. *Ovary* globose disciform, c. 2 by 3 mm, ferruginously puberulous. Style filiform, 6—15 mm long, glabrous. *Fruits* ellipsoid-ovoid, up to 3 by 1.8 cm, 1-seeded, rounded at apex, with a short remnant of the style which is widened at its base, base of fruit attenuate, glabrous, pericarp fleshy. Seeds incompletely known.

Type specimen: *Thwaites* 2402 in K.

Vernacular name: hin-molpedda.

Distribution: Ceylon.

CEYLON. without known loc.: *Thwaites* 3402 (K, L), fl. & incomplete fruits.

Remarks. This species is very closely related to *P. grande* but differs in the smaller leaves, the smaller number of secondary nerves which, moreover, ascend at a larger angle from the midrib and are straight. Also the number of flowers in each axil is smaller than that of *P. grande*. The sizes of the flower are smaller than those of *P. grande* and also the pubescence at the base of the filaments is more extensive.

According to King and Alston, l. c., the wood does not resemble *P. grande* in any respect.

The combination *P. parvifolium* has been used before by Burret in 1886 (Ann. Jard. Bot. Btzg 5, p. 39) and therefore a new name had to be chosen.

94. *P. sukoei* Fischer, Kew Bull. 1933, 365.

Trees, up to 35 m high. Branchlets irregularly terete, ferruginously tomentose but soon glabrous; terminal cone up to 7 mm long, tomentose; stipules linear, up to 8 by 1 mm, tomentose on outside, glabrous on inside, caducous. *Leaves* subconferted at tips of branchlets or scattered, elliptic, elliptic-obovate or obovate, 7—14 by 3.5—7 cm, rounded or obtuse, sometimes slightly obtusely acuminate at apex, narrowly to broadly cuneate at base, sometimes rounded, shortly decurrent along sides of petioles; glabrous on either side, sometimes ferruginously sericeous above at base of midrib,

subcoriaceous; midrib flat above, sometimes slightly grooved, prominent and rounded or angular below, secondary nerves 7—11 pairs, ascending at an angle of 55° — 75° , at base up to 90° , curved, sometimes straight and curved, distinctly archingly joined rather far from the margin, prominulous but distinct above, prominent below, tertiary nerves few, coarse, widely reticulate, reticulation outside the arches of the nerves also distinct. Petioles 10—17 mm long, flat above, rounded below, whitish almost over its whole length, glabrous. *Flowers* solitary, or 2 or 3 together in the axils of the higher leaves or their sears, pedicels angular, 12—22 mm long, pale orange-brown tomentose. *Sepals* ovate-lanceolate, 6.5—7.5 by 3—4 mm, subobtusate at apex, densely pale orange-brown tomentose on outside, sparsely sericeous on inside except for the basal part, inner sepals broader, more rounded at apex, margins membranous and glabrous, descendingly woolly fimbriate along edges. *Corolla* 9.5—12 mm, glabrous on either side, lobes ovate-lanceolate, 6.5—8 by 2.5—3 mm, rounded and scarious at apex. *Stamens* 12, 4.5—6 mm long, filaments 3—4 mm long, ferruginously woolly in the basal half, anthers ovoid-oblong, 2.5—3 mm long, connective prolonged and bifid at apex, glabrous, dehiscing extrorsely. *Ovary* conoid, c. 1 by 2 mm, 6-celled, densely ferruginously hirsute. Style filiform, 10—13 mm long, 12-ribbed, glabrous. *Fruits* ellipsoid-ovoid or ellipsoid, 1.6—4.5 by 0.9—2.2 cm, 1-seeded, obtuse and with a short remnant of the style, which is star-shaped widened at base, pericarp thin-woody, densely covered with a whitish layer of lepidote-like flakes which are not easy to remove. Seeds fusiform, laterally compressed up to 2.5 by 1 by 0.7 cm, acute at either end, testa rather thick, yellow, scar elliptic, as long as seed, up to 3 mm wide, greyish, dull, embryo exalbuminous.

Type specimen: *Sukoe 11091* in K.

Vernacular names: mayang, nyatoh daun jangus (Malaya), pyinlebyin (Burma).

Ecology: In forests at low altitudes.

Distribution: Burma and Malaya.

BURMA. Tenasserim, Tharapou, alt. 260 m: *Sukoe 11091* (K), fl. May; ibidem: *Sukoe 10896* (K), fr. Febr.

MALAYA. Perak, Bulu For. Res.: *Symington 28591* (KEP), fl. March; ibidem: *Symington 30409* (KEP, SING), fl. April; Parit For. Res.: *Symington 39560* (KEP), fr. April; ibidem: *Bakar 65853* (KEP), tree 30 m, fr. Sept.; ibidem: *Lazim 34304* (SING), tree 35 m, April; ibidem: *Symington 39475* (KEP), tree, fl. April; Chikus For. Res.: *KEP 65056* (KEP), tree 33 m, Nov.; Larut, Padaung Gajah: *Hodgson 5693* (KEP), tree, Nov.; Dindings, Lumut For. Res., alt. 280 m: *KEP 76724* (KEP), tree 30 m, July; Johore, Sungei Kayu area, Mawai-Jemaluan Rd, in dry Dryobalanops forest: *Corner 29379* (BO, SING), fr. May; ibidem: *Kiah SF 31995* (SING), tree 10 m, fr. Oct.; ibidem: *Corner 32990* (SING), tree 30 m, fl. June; ibidem: *Corner 29320* (SING), fl. May.

95. *P. thwaitesii* Trimen, Handb. Fl. Ceylon 3, 1895, 84; Lam, l. c. 1925, 258; Lam, l. c. 1927, 414; King & Alston, Ann. Roy. Bot. Garden, Peradeniya 11, 3, 1930, 295 — *Isonandra lanceolata* Thwaites, Enum., 1864, 442 — *Palaquium engleri* H. J. Lam, l. c. 1925, 107 — *Dichopsis lanceolata* (Thwaites) Clarke in Hooker f., Fl. Br. India 3, 1882, 541 — *Dichopsis lanceolata* Trimen, Syst. Cat., 1885, 51 — *Palaquium lanceolatum* (Thwaites) Engler, Bot. Jahrb. 12, 1890, 511 — *Bassia lanceolata* (Thwaites) Beddome, For. Man., 1870, 141.

Medium-sized trees. Branchlets terete, grooved, slender, 1.5–2.5 mm in diam., reddish ferruginously puberulous but soon glabrous; terminal cone up to 2 mm long, puberulous; stipules ovate-lanceolate, up to 2 by 1 mm, acute at apex, reddish ferruginously puberulous on outside, glabrous on inside, soon caducous. *Leaves* scattered, narrowly elliptic, lanceolate, or ovate-elliptic, 8.5–13 by 2.3–3.1 cm, apex obtusely acuminate, acumen up to 1 cm long, base cuneate, decurrent along adaxial side of petiole; subcoriaceous, juvenile leaves scattered ferruginously tomentose above and densely puberulous below, mature ones glabrous above and scattered puberulous or glabrous below; midrib grooved above, prominent and rounded below, secondary nerves 9–11 pairs, ascending at an angle of 50°–55°, straight, curved at the tips and archingly joined, inconspicuous above, slightly more distinct below, tertiary nerves widely reticulate, few, hardly visible on either side. Petioles 1–2.2 cm long, narrowly grooved above, finely whitish puberulous or glabrous, thickened and rugose at base. *Flowers* axillary, solitary or in clusters of 2, pedicels subangular, c. 1 cm long, ferruginously sericeous. *Sepals* lanceolate-ovate, 6.5–7.5 by 3.5–4 mm, subobtusate at apex, ferruginously puberulous on outside, glabrous on inside, inner sepals with membranous, glabrous and fimbriate margin. *Corolla* and *stamens* unknown. *Ovary* subglobose, c. 2 by 3 mm, 6-celled, ferruginously puberulous. Style filiform, up to 1.5 cm long, glabrous. *Fruits* unknown.

Lectotype specimen: *Thwaites 3679* in K.

Distribution: Ceylon.

CEYLON. *Cultura*: *Thwaites 3679* (CAL, K), tree, fl. without corolla and stamens.

Remark. On account of the already existing combination *Palaequium lanceolatum* Blanco, Trimen has been forced to give a new specific epithet when inserting *Isonandra lanceolata* Thwaites in *Palaequium*.

96. ***P. xanthochymum*** (de Vriese) Pierre in Burck, Ann. Jard. bot. Btzg 5, 1886, 30; King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr 17, 1905, 194; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 11; Ridley, Fl. Mal. Pen. 2, 1923, 275; Lam, l. c. 1925, 73, f. 19; Heyne, Nutt. Pl. Ned.-Indië, ed. 2, 2, 1927, 1242; Lam, l. c. 1927, 405; Heyne, l. c., ed. 3, 1, 1950, 1242; Wyatt-Smith, Research Pamphlet, 1954, 45, 1 fig. — *Isonandra xanthochyma* de Vriese, Nat. Tijdschr. Ned.-Indië 21, 1860, 311 — ? *Dichopsis rubens* Clarke in Hook. f., Fl. Br. Ind. 3, 1882, 543 — *Palaequium rubens* (Clarke) Engler, Bot. Jahrb. 12, 1890, 511 — *Palaequium lanceolatum* Burck, l. c. 1886, 43.

Trees, up to 40 m high. Branchlets irregularly angular by the numerous leaf-scars, 3–10 mm in diam., greyish or ferruginously puberulous near apex only; terminal cone up to 5 mm long, greyish or ferruginously puberulous; stipules ovate, up to 3 by 1.5 mm, acute at apex, greyish or ferruginously puberulous on outside, glabrous on inside, usually soon caducous (in var. *puberulum* long persistent). *Leaves* scattered but sometimes subconferted near apex of branchlets, obovate, elliptic, lanceolate or spatulate, 6–20 by 2.2–6 cm, retuse, rounded, obtuse or obtusely acuminate at apex, acumen up to 5 mm long, base narrowly cuneate to subrotundate, decurrent along adaxial side of petiole; usually coppery reddish when dry, either glabrous on either side or puberulous below, sometimes along midrib

only, chartaceous or coriaceous; midrib grooved above and minutely crested, rounded or angular below, secondary nerves 12—16(—20) pairs, ascending at an angle of 55°—65°, usually slightly curved and stronger so near their tips, sometimes straight and curved at tips only, irregularly archingly joined, prominulous above and sometimes grooved, prominent below, tertiary nerves few, transverse but sometimes very irregular and giving the impression of a reticulate nervation, usually prominulous above, sometimes inconspicuous, prominulous below but sometimes inconspicuous also. Petioles 7—11(—32) mm long, grooved above, either rounded or angular below, glabrous or ferruginously or greyish puberulous. *Flowers* in (2—)3—7-flowered, axillary clusters, pedicels terete or angular, (1.5—)3—12 mm long, in fruit up to 22 mm, greyish or ferruginously puberulous. *Sepals* ovate-triangular, 2.5—3 by 1.5—2.2. mm, apex obtuse, ferruginously puberulous on outside, glabrous on inside, fimbriate, inner sepals with membranous margins. *Corolla* 6.5—11 mm, entirely glabrous, lobes lanceolate, 4.5—7 by 1.5—2.5 mm, apex obtuse. *Stamens* 12, some or all cohering at their base, 3—4 mm long, filaments subulate, 1.5—2.5 mm long, glabrous, anthers oblong, 2—3 mm long, apex acute or bifid, glabrous, dehiscing extrorsely. *Ovary* ovoid, c. 1 by 1 mm large, 6-celled, glabrous, subabruptly passing into the filiform, 9—14 mm long, glabrous style. *Fruits* obliquely fusiform, 3—5 by 1—1.7 cm, 1- or 2-seeded, acuminate at either end, at apex often with a short remnant of the style, pericarp thin, fleshy, glabrous. Seeds fusiform, 2—4 by 0.6—0.8 cm, obtuse at apex, subacute at base, testa very thin, blackish brown, scar covering about half of the seed, greyish, dull, albumen none, radicle acute, almost not exerted.

Type specimen: *Motley VI 1366* in BO.

Use: The timber is used for boards and boats, in Sandakan it is used for making furniture shelves.

Ecology: *P. xanthochymum* is a species of swampy forests, but also of dry ground in lowland forest and on low hills, one variety is found growing at higher altitudes.

Distribution: Malaya, Sumatra, Riouw, Lingga, Banka, Java, Borneo.

Var. *xanthochymum* — *P. xanthochymum* (de Vriese) Pierre in Burret, var. *glabrum* H. J. Lam, l. c. 1925, 73, f. 19, c, e—h; Lam, l. c. 1927, 406.

Stipules soon caducous. Pedicels 3—9 mm long. *Leaves* membranous to subcoriaceous, flaccid.

Type specimen: *Motley VI 1366* in BO.

Vernacular names: Perak: nyatoh babi, n. jangkang, n. kabu, n. paya; Johore: ketiau; Lingga: njato; Banka: njato rengang, n. riengoeng; Borneo: natu ringkau, njantu, njato bawoei, n. djangkar.

Distribution: Malaya, Sumatra, Riouw, Lingga, Bangka, Java, Borneo, Philippines.

MALAYA. Selangor, Kuang Res.: Walton 21050 (SING), Sept. — Johore, Sungai Sedili, by riverside: Corner 29265 (A, BO, SING), fl. April; ibidem: Corner 25990 (BO, NY, SING), tree 30 m, fl. Aug.; ibidem: Corner 25891 (NY, SING), tree, fl. buds July; Mawai: Ngadiman SF 34758 (SING), tree 15 m, fr. Jan.; ibidem: Ngadiman 36796 (BO, SING), tree 26 m, imm. fr. July; Sungei Langar: Feob 5838 (SING), fr. Dec.; Sungei Tementang, Mawai: Ngadiman 34718 (BO), tree, fr. Jan. — Singapore, Bukit Mandai: Ridley 3637a (BM, SING), fl.; ibidem: Kiah 37122

(BO, SING), tree 25 m, fr. July; Changi: *Ridley 3639a* (SING), fl.; ibidem: *Cantley 63* (SING), tree, fl. white; without loc.: *Maingay 995* (BO, K, L), type specimen of *Dichopsis rubens* Clarke.

LINGGA. f. Lam, l. c. 1925.

RIOUW. Indragiri Highlands, alt. 6 m: *NIFS bb 28507* (A, BO, L), July.

SUMATRA, f. Lam, l. c. 1925, also: Djambi, Simpang: *NIFS bb 12881* (BO), tree 25 m, Nov.

BORNEO. Indonesian Borneo, Bandjermasin: *Motley VI 1366* (BM, BO, L), fl. fr.; Muara Teweh, alt. 25 m: *NIFS bb 28084 & 28085* (BO, L, SING), fl. May; Sungei Terentang: *NIFS bb 12611* (BO), tree 30 m, June.

JAVA. Djasinga, Dungus Iwul, alt. 175 m: *van Steenis 11215* (BO, L, SING), tree, fr. Dec.; ibidem: *van Steenis 11216* (BO, L, SING), tree, Dec.

LUZON. prov. Camarines Sur, Mt Potianay, alt. 1300 m: *Edaño 75985* (NY), tree 4 m, fl. buds Nov.

Var. **puberulum** H. J. Lam, l. c. 1925, 74, f. 19a, b, d; Lam, l. c. 1927, 406.

Stipules long persistent. Pedicels 1.5—3 mm long. Leaves chartaceous or subcoriaceous, flaccid.

Type specimen: *Beguin 577* in BO.

Vernacular name: suwakat.

Distribution: Sumatra.

SUMATRA. Bengkalis, Panglang, Sungei Missigit, alt. c. 6 m: *Beguin 577* (BO, L), tree 31 m, fl. Jan.

Remark. It must be pointed out that some of the leaves are glabrous below as well as some being pubescent, so watering down the limits of this variety against var. *xanthochymum*.

Var. **montanum** H. J. Lam, l. c. 1927, 406.

Stipules soon caducous. Pedicels 3—12 mm long. Leaves stiff, coriaceous.

Lectotype specimen: *NIFS bb 2755* in L.

Vernacular names: majang bunga, majang kapu, majang tajung.

Distribution: Sumatra.

SUMATRA. East Coast, Sibutan reserve, alt. c. 1400 m: *NIFS bb 2755* (BO, L), tree 30 m, Jan.; Karo countries, near Lautkawar, alt. c. 1600 m: *NIFS bb 8640* (BO), tree 25 m, fl. July; ibidem, near Lau Buluh: *NIFS bb 11983* (BO), tree 46 m, Sept. — Tapanuli, Angkola & Sipirok, near Situmba, alt. c. 1300 m: *NIFS bb 6153* (BO), tree 27 m.

Remarks. This variety is provisionally kept in *P. xanthochymum* though the stiffness of the leaves and the quite different habitat and altitude on which this variety is growing, rather point to a separate species. However, the material is so scanty that a decision about its real status has to be postponed. It must be pointed out that the leaves are puberulous below and the tertiary nerves are distinct below, contrary to Lam's description.

97. **P. microphyllum** King & Gamble, J. As. Soc. Beng. 74, 2, Extra Nr 17, 1905, 196; Ridley, Fl. Mal. Pen. 2, 1923, 276; Lam, l. c. 1925, 36, f. 5; Lam, l. c. 1927, 395; Heyne, Nutt. Pl. Indonesia, ed. 3, 1, 1238; Wyatt-Smith, Research Pamphlet 4, 1954, 37—38.

Trees, up to 35 m. Branchlets terete, 2.5—5 mm in diam., reddish ferruginously tomentose or woolly, glabrescent; terminal cone 2—8 mm long, reddish ferruginously woolly; stipules absent. Leaves scattered or subconferted at apex of branchlets, spatulate, 2.5—8.5 by 1.5—4 cm, short

obtusely acuminate, rarely rounded, acumen up to 3 mm long, tapering towards the narrowly cuneate base; glabrous above except sometimes whitish or ferruginously tomentose in the basal part, scattered whitish or ferruginously tomentose below but sometimes on the midrib and/or of basal part of leaf only, sometimes mature leaves completely glabrous, thinly coriaceous; midrib provided with one or two crests above, prominent and angular below, secondary nerves (8—)10—14(—20) pairs, ascending at an angle of 70°—80°, slender, sometimes hardly separable from the tertiary nerves, straight but sometimes slightly curved, archingly joined near margin of leaf, conspicuous on either side but sometimes hardly visible above, tertiary nerves reticulate, parallel to secondary nerves, slender. Petioles (5—)7—12(—17) mm long, flat or shallowly grooved and usually crested above, reddish ferruginously or greyish woolly or tomentose. *Flowers* solitary or in 2—5-flowered, axillary clusters, pedicels 2—5 mm, ferruginously pubescent. *Sepals* broadly ovate, 2.5—3 by 2.5—3 mm, apex obtuse or indistinctly acuminate, ferruginously tomentose on outside, glabrous on inside, margins woolly fimbriate, inner sepals narrowly ovate, 2—2.5 by 1.5—2 mm, apex obtuse, for the rest similar to the outer sepals but margins smooth. *Corolla* 4—5 mm long, ferruginously tomentose on outside in the middle-line, at apex of the lobes and the whole tube, lobes elliptic, 3—3.5 by 2—2.5 mm, apex obtuse. *Stamens* 12, inserted at base of lobes, 3—3.5 mm long, filaments filiform, 2—2.5 mm long, anthers ovoid, 1.5—2 mm long, glabrous, apex mucronulate, dehiscing lateral-introrsely. *Ovary* conoid, c. 1.5 by 1.5 mm, 6-celled, indistinctly 6-lobed, ferruginously tomentose. Style filiform, up to 8 mm long, 6-ribbed, glabrous. *Fruits* obovoid to globose, 12—22 by 8—22 mm, apex rounded or subacute, often crowned by the remnants of the style, sometimes attenuate at base, 1-seeded, pericarp fleshy, thick, glabrous. Seeds ovoid-ellipsoid, up to 20 by 12 mm large, testa crustaceous, glossy, pale brown-yellow, scar covering half the surface of the seed, embryo exalbuminous, radicle small, punetiform.

Type specimen: *Ridley 10840* in SING.

Vernacular names: Johore: nyatoh chiku; Perak: nyatoh, n. balam; Malaya: djelutung batu, nyatoh pipit, taban simpur; Borneo: nyatoh merah.

Ecology: Uncommon species of lowland and swamp forest.

Distribution: Malaya, Sumatra, Lingga, Riouw, Banka, Borneo.

MALAYA. Singapore, Bukit Timah: *Ridley 10840* (SING), fl.; ibidem: *Liew 36481* (BO, KEP, SING), fl. June; Botanical Garden: *Nur s.n.* (NY, SING), fr. Sept.; Bukit Timah: *Corner 33587* (SING), tree, July; ibidem: *Liew 36454* (SING), fl. June; ibidem: *Corner 34516 & 34671* (BO, SING), tree, Febr./Nov.; ibidem: *Sinclair 33245* (E, SING), fl. Sept. — Perak, Kledang Siaong Res.: *Puteh 39194* (KEP), Nov.; Ulu Langat, Bukit Tunggul For. Res.: *Salleh bin Ka 63604* (KEP), Sept., tree 28 m — Selangor, Kanching: *Symington 29848* (KEP), Dec.; Serendah For. Res., Ulu Selangor: *KEP 66656* (KEP, L), fl. March, tree 30 m — Negri Sembilan, Senaling Inas For. Res.: *Ibrahim 42822* (KEP), tree 45 m, Nov. — Johore, J. East, Mt Arong For. Res.: *Sulaiman bin Manja 70230* (KEP), July, tree 37 m; ibidem: *FMS 35959 & 35960* (KEP), tree, Nov.; ibidem: *Sulaiman bin Manja 74158* (KEP), Dec.

RIOUW. Karimoen, Moro, P. Soegi Bawah, alt. 140 m: *NIFS bb 20383 & 20384* (BO, L, NY, SING), fr. Dec.

LINGGA, f. Lam, l.c. 1927, 36; Bakong: *NIFS RI/I-39* (BO), tree, Febr.

BANGKA, f. Lam, l.c. 1927, 36.

SUMATRA, f. Lam, l.c. 1927, 36—37, also; S.W.C., Padang, Sungei Laras, Kotah Tengah, alt. 895 m: *NIFS* bb 20312 (BO, L), Febr.

BORNEO. Sarawak, Elopura For. Distr., Kabili-Sepilok For. Res., alt. 45 m: *Puasa & Enggoh* 10676 (KEP, L), tree 30 m, fl. Oct. — Brunei, Seria, mixed peat swamp on edge of *Shorea albida* forest: *Smythies, Wood & Ashton* 5886 (L), tree 35 m, fl. April — Indonesian Borneo, Western Div., Melawi, S. Kelawai deras: *NIFS* bb 28102 (BO, L, SING), May; ibidem, Smitan, B. Saguk: *NIFS* bb 32288 (BO, L), May; SE division, Tidung Lands, Tanah Merah: *NIFS* bb 18278 (BO), Dec.; ibidem, Bulungan, Salimbatu, alt. 150 m: *NIFS* bb 11189 (BO), tree 33 m, Aug.

98. *P. rufolanigerum* van Royen, n. sp. — Fig. 24.

Arbor magna. Ramuli irregulariter teretes, ferrugineo-lanati, glabrescentes; stipulae ignotae. Folia spathulata, $6.8-9.4 \times 2.4-3.2$ cm, apice rotundata, supra glabra, sed in costae basali parte cinereo-lanata, subtus glabra sed ad costam obscure rubro-brunneo-lanata. Nervi secundarii utroque latere 7—11, arcuato-connati, tertiarii reticulati. Petiolus 0.2—0.7 cm longus, lanatus. Pedicellus 0.8—1.2 cm longus, ferrugineo-lanatus. Sepala 6, extus ferrugineo-lanata, intus glabra. Corolla extus ad tubum et in parte centrali loborum ferrugineo-sericea, intus fauce ferrugineo-sericeo excepta glabra.

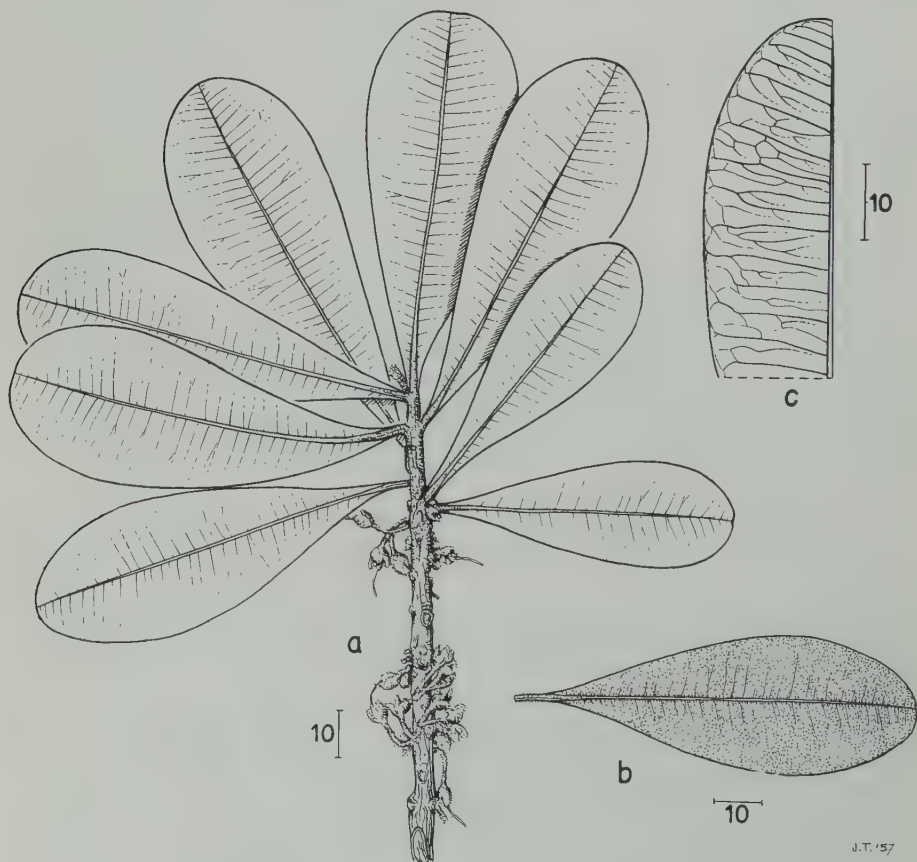


Fig. 24. *P. rufolanigerum*, a, branchlet with leaves and flowers; b, leaf; c, tertiary nervation of leaf (Rambli 1753).

Stamina 12, glabra. Ovarium 6-loculare, ferrugineo-hirsutum; stylus basi excepta glaber. Fructus ignotus. Typus: *Rambli 1753* in SAR.

Trees, up to 20 m. Branchlets irregularly terete, c. 4 mm in diam., dark ferruginously woolly, but soon glabrous; terminal cone up to 4 mm long, woolly; stipules? *Leaves* subconferted at tip of branchlets, spatulate, 6.8–9.4 by 2.4–3.2 cm, rounded at apex, narrowly cuneate at base, decurrent along sides of petioles; glabrous above except greyish brown woolly in basal part of midrib, glabrous below but dark reddish brown woolly on midrib, coriaceous; midrib crested above, prominent and angular below, secondary nerves 7–11 pairs, ascending at an angle of 85°–90°, straight, archingly joined closed to margin, prominulous on either side, not easily discernable from tertiary nervation, the latter reticulate, lax, prominulous on either side. Petioles 2–7 mm long, woolly on either side, crested above, angular below. *Flowers* 2 or 3 in the axils below the leaves, pedicels angular, 8–12 mm long, dark ferruginously woolly. *Sepals* ovate-triangular, c. 4 by 4 mm, obtuse or subacute, dark ferruginously woolly on outside, glabrous on inside, inner sepals more ovate with membranous, glabrous margins, and smaller. *Corolla* 5.5–7 mm long, ferruginously sericeous on outside on tube and in a central spot at base of lobes up to the middle of the latter, glabrous on inside, except for a ferruginous sericeous pubescence in throat, lobes lanceolate, 4–5 by 1.5–2 mm, rounded or subtruncate at apex. *Stamens* 12, 4.5–5.5 mm long, entirely glabrous, filaments filiform, 3–3.5 mm long, anthers lanceolate, 2–2.5 mm long, connective slightly prolonged, bifid, dehiscing extrorsely. *Ovary* globose-ovoid, c. 2.5 by 2.5 mm, 6-celled, dark ferruginously hirsute. Style filiform, up to 10 mm long, glabrous except for the hirsute base. *Fruits* unknown.

Type specimen: *Rambli 1754* (= *S 48*) in SAR.

Distribution: Borneo.

BORNEO. Sarawak, Kuching, Semengho For. Res., alt. 300 m: *Rambli 1753* (SAR), tree 20 m, fl. Sept.

Remarks. An easily distinguishable species by the spatulate leaves which are dark ferruginously woolly on underside of the angular midrib, and by the woolly pubescent petioles, pedicels and outside of sepals. It is closely related to *P. pseudorostratum* and *P. microphyllum*. From both it differs in the woolly pubescence mentioned above. From the former, moreover, it can be separated by the pubescence on the outside of the corolla and from the latter by the pubescence on the inside of the corolla.

99. *P. semaram* H. J. Lam, l. c. 1925, 43, 255, f. 6; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1240; Lam, l. c. 1927, 397; Heyne, l. c., ed. 3, 1, 1950, 1240; Wyatt-Smith, Research Pamphlet 4, 1954, 42.

Trees, 30–50 m. Branchlets angular or terete, irregular by the numerous scars, 2–10 mm in diam., ferruginously, greyish-brown or greyish woolly as are the lower and basal part of upper side of petioles, pedicels and the sepals; branchlets glabrescent; terminal cone up to 10 mm long, with the same indumentum as the juvenile branchlets, apex abruptly rounded or truncate; stipules absent. *Leaves* conferted at apex of branchlets, spatulate, obovate-oblong or rarely linear-lanceolate, 9–13.5(–19) by 3–6(–8) cm, apex rounded or obtusely acuminate,

acumen up to 3 mm, in sucker-leaves up to 12 mm long, base narrowly cuneate, decurrent along sides of petioles; glabrous on either side but dark reddish woolly along midrib underneath and its basal part above, coriaceous; midrib grooved above and minutely crested mainly in the basal part, prominent below, secondary nerves 18—25 pairs, ascending at an angle of (70°—)80°—90°, straight, irregularly archingly joined, slender, prominent on either side, at base and apex of leaf hardly separable from the tertiary nerves, the latter reticulate, parallel to secondary nerves, slender, prominent on either side. Petioles (0.8—)1.5—2.5 cm long, woolly, ultimately subglabrous, sometimes transversely verrucose below in the basal part. *Flowers* in 2—6-flowered, axillary clusters, pedicels angular, 8—15 mm long, in fruit 13—22 mm long, woolly. *Sepals* ovate, 3.5 by 2.5—3.5 mm, apex shortly obtusely acuminate, sometimes crested, woolly on outside, glabrous on inside, inner sepals elliptic, 3.5—4.5 by 2.5—3 mm, apex rounded, margins membranous and fimbriate, woolly on outside, glabrous on inside. *Corolla* 6—9 mm long, glabrous, when young with a few golden hairs in epipetalous lines on the tube, lobes ovate-elliptic, 5—7.5 by 2.5—3.5 mm, apex obtuse, fimbriate. *Stamens* 12, 6—8.5 mm long, filaments filiform, angular, 3.5—5 mm long, glabrous, anthers sagittate, 4—5 mm long, apex aristulate, truncate, emarginate or acute, glabrous, dehiscing extrorsely. *Ovary* ovoid, c. 1.5 by 1.5 mm, 6-celled, ferruginously tomentose. Style filiform, 10—15 mm long, glabrous. *Fruits* ellipsoid, sometimes slightly oblique or obovoid, 2.5—3.5 by 0.8—1.5 by 0.6—1.5 cm, sometimes 6-lobed, 1-seeded, apex obtuse, usually with a short remnant of the style, glabrous except for a ring of ferruginous hairs at the base and at the base of the style, pericarp fleshy. Seeds ovoid, 12—18 by 6—8 mm, obtuse at apex, acute at base, testa thin, scar covering about half the surface of the seed, embryo without albumen, cotyledons thick, radicle small, almost not exsert.

Lectotype specimen: *Beguin* 392 in L.

Vernacular names: Malaya: nyatoh semaram (Malacca, Pahang, Kelantan), nyatoh (Pahang); Lingga: lakis bukit daun lebar; Sumatra: balam hitam, balam semina, balam serindit, nyatoh semaram, pulau pipit.

Ecology: Frequent tree of lowland and low-lying forest in the coastal belt.

Distribution: Malaya, Sumatra, Lingga.

MALAYA. Johore, Sungai Kayu, Mawai-Temalurang Road, swampy forest: *Corner s.n.* (SING), tree 50 m, fr. Febr., green; Kulai Young Estate: *Corner* 36298 (BO, SING), fl. June; Sungai Rhu Reba, Jason Bay: *Corner* 28516 (BO, SING), fl. June, top storey tree; Mawai: *Ngadiman* 36793 (SING), tree 25 m, fl. pale yellow, July; ibidem: *Wyatt-Smith* 71887 (KEP, L), tree 30 m, fr. green, Jan. — Pahang, Sungai Tahan, on ridge: *Kiah* 31797 (SING), tree 25—30 m, fr. July; Roempin Pahang: *Mohammed* 14957 (SING), fl. May; ibidem: *Maw* 29451 (KEP), May; Ulu Anak Endau Sh.: *KEP* 17257 (KEP), tree 25 m, fr. March; Kuantan: *Lambak* CF 3556 (BO), tree, fl. July — Malacca, Mersing, Mt Arsong For. Res., alt. 16 m: *Awang bin Deli* 70108 (KEP), tree 40 m, Jan.; ibidem: *Dimal* 70078 (KEP), tree 40 m, fr. Jan. — Trengganu, Dungun, Besul State Cans. Lic.: *KEP* 66955 (KEP), tree 33 m, fr. Jan., green — Kelantan, Selih Sungai, Pergan: *Wallon* 33258 (KEP), large tree, March — Kuantan, Juru Lalang S. L.: *Ali* 29996 (KEP), large tree, March.

SUMATRA. Indragiri Low Lands, Simpang, alt. 5 m: *NIFS* bb 22278 (BO, L, SING);

Gelang Isl.: *NIFS* bb 29147 (BO, L), Sept.; Belimbing: *Buwalda* 286 (BO, L), tree 26 m, July; Keritang, alt. 5 m: *NIFS* bb 28680 (BO, L), Aug.; Padang upper Lands, Minangkabau, Paiman Doekoc, alt. 150 m: *NIFS* bb 3110 (BO, L), Febr. — B e n g k a l i s, Sebaoek, alt. 2 m: *Beguín* 392 (BO, L), fl. Oct.; ibidem, Tamansari: *Beguín* 241 (BO, L), fr. Aug.; Selat Pandjang: *NIFS* bb 13835 (BO), tree 23 m, Oct.; Tj. Sei Lakar: *NIFS* bb 12844 (BO), tree 25 m, fl. Oct.

LINGGA. Singkep, Mt Gambang, alt. 100 m: *NIFS* bb 4042 (BO, L), Sept.

R e m a r k. Contrary to Lam's description I have been unable to trace any sign of stipules.

100. *P. glabrifolium* Merrill, Phil. Journ. Sc. 14, 1919, 416; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l.c. 1925, 46; Lam, l.c. 1927, 398.

Small trees, up to 8 m. Branchlets angular, 2—4 mm in diam., greyish ferruginously puberulous, glabrescent; terminal cone up to 3 mm long, puberulous; stipules lanceolate, c. 2 by 1 mm, acute, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered or subconferted at apex of branchlets, oblong-obovate, 9—14 by 2.5—5 cm, short obtusely acuminate at apex, acumen up to 5 mm long, narrowly cuneate at base; glabrous on either side, thin-coriaceous; midrib grooved above and very minutely crested as well, rounded or angular below, secondary nerves (11—)14—20 pairs, ascending at an angle of 70°—80°, straight, irregularly archingly joined at their tips, very slender, prominulous on either side but more distinct below, tertiary nervation parallel to secondary nerves and widely reticulate, very slender, prominulous on either side but more distinct below. Petioles 1—2.5 cm long, flat above, rounded below, glabrous. *Flowers* solitary or in fascicles of 2—4, axillary, pedicels angular, 1—1.5 cm long, entirely glabrous. *Sepals* broadly ovate, c. 3 by 3.5 mm, obtusely acuminate, glabrous on either side, inner sepals slightly smaller, obtuse or rounded, membranous along margins, ferruginously tomentose on outside except along the marginal part. *Stamens* and *corolla* not seen. *Ovary* ovoid-conoid, c. 2 by 2 mm, 6-lobed, ferruginously puberulous; style c. 9 mm long, 6-ribbed, glabrous. *Fruits* globose, c. 2—4 cm in diam., seeds unknown (f. Lam 1925).

Type specimen: *Ramos & Edaño* 30820 in PNH.

Lectotype specimen: *Ramos & Edaño* 30820 in K.

Distribution: Panay.

PANAY. Capiz prov., Mt Macosolon: *Ramos & Edaño* 30820 (K), fl. Aril/May.

R e m a r k. Since the type specimen has become lost, the only specimen traced has been chosen to represent the type specimen.

101. *P. dubardii* Elmer, Leaf. Phil. Bot. 3, 1910, 868; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 279; Lam, l.c. 1925, 38; Lam, l.c. 1927, 395.

Trees, c. 10 m. Branchlets angular, 3—7 mm in diam., ferruginously tomentose, glabrescent; terminal cone up to 5 mm long, ferruginously tomentose; stipules subulate, c. 1 mm long, ferruginously tomentose, caducous. *Leaves* conferted at apex of branchlets, elliptic-obovate, (6—)8—12 by (3—)3.5—4.5 cm, short indistinctly obtusely acuminate, sometimes emarginate, subabruptly narrowed at base, decurrent along adaxial side of petiole; glabrous on either side, except for a few hairs in basal part underneath,

coriaceous; midrib impressed above and minutely crested, prominent and rounded below, secondary nerves 7—14 pairs, ascending at an angle of c. 50° , straight but at their tips slightly curving backwards and forked, archingly joined rather far from the margin but the arches very irregularly sinuous, grooved above and sometimes rather inconspicuous, prominent below, tertiary nerves reticulate, parallel to the secondary nerves, inconspicuous on either side but sometimes more distinct below. Petioles (10—)13—20 mm, flat above and crested, rounded below, greyish or ferruginously tomentose. *Flowers* solitary or in 2- or 3-flowered, axillary clusters, pedicels 6—8 mm long, but up to 12 mm long in fruit, greyish or ferruginously tomentose. Outer *sepals* narrowly ovate, 3—3.5 by 1.5—2 mm, apex usually obtuse, occasionally acute, ferruginously puberulous on outside, glabrous on inside, inner sepals orbicular, c. 3 mm in diam., rounded at apex, ferruginously puberulous on outside, glabrous on inside, margins membranous and finely hairy. *Corolla* c. 6 mm long, glabrous on either side, lobes elliptic-ovate, c. 4 by 2.5 mm, apex acute. *Stamens* 12, 3—3.5 mm long, filaments angular-subulate, c. 1 mm long, anthers sagittate, c. 2 mm long, apex acute, sparsely brownish hairy, dehiscent extrorse-laterally. *Ovary* ovoid, c. 1.5 by 1 mm, 6-celled, 6-lobed, ferruginously puberulous. Style subulate, c. 4 mm long in flower, in fruit up to 8 mm, glabrous. *Fruits* not seen but according to Elmer: globose ellipsoid, 12.5 mm long, 2- or 3-seeded, hard, green, smooth.

Type specimen: *Elmer 12553* in PNH.

Lectotype specimen: *Elmer 12553* in L.

Vernacular name: molito (Panáy Bisáyan).

Ecology: In primary forests at 200—600 m alt. on red soil with gravelly subsoil on wooded banks.

Distribution: Sibuyan, Panay, Luzon, Palawan, Samar.

SIBUYAN. Capiz prov., Magallanes, Pauala river, alt. 250 m: *Elmer 12553* (E, FI, G, L, NY), fl. & fr. May; Mt Giting-giting: *Elmer 12126* (E, FI, G, L, NY), fl. March.

PANAY, f. Merrill, l.c. 279.

LUZON. Zambales prov.: *Vidal 1557* (FI, K, L), fl. buds Nov.

PALAWAN. Palawan prov., Mt Pulgar: *Elmer 12813* (E, FI, G, L, NY), fl. March.

SAMAL. without known loc.: *Angeles 27732* (SING), May.

Remarks. As the type specimen has been destroyed in Manila a lectotype specimen is chosen from the original material.

102. *P. calophylloides* Ridley, J. As. Soc. Straits 79, Sept. 1918, 93 and Fl. Mal. Pen. 2, 1923, 276; Lam, l.c. 1925, 105; Lam, l.c. 1927, 413.

Trees, up to 20 m. Branchlets angular, 2—4 mm in diam., greyish puberulous, glabrescent; terminal cone up to 3 mm long, puberulous; stipules lanceolate, up to 3 by 1 mm, acute, ferruginously puberulous on outside, glabrous on inside, caducous. *Leaves* subconferted at apex of branchlets, obovate, 8—12.5 by 4.5—6 cm, short obtusely acuminate at apex, cuneate at base, constricted near petiole; glabrous on either side, when young finely brown puberulous below, coriaceous; midrib crested above, prominent and angular below, secondary nerves slender, 10—16 pairs, ascending at an angle of 65° — 75° , slightly curved, diminishing until in-

conspicuous near margin or irregularly archingly joined, prominulous above but often grooved, prominent below, tertiary nervation reticulate-parallel to secondary nerves, inconspicuous or absent above, prominent below. Petioles 1.8—2.4 cm long, crested above, angular below, thickened and rugose at base, glabrous. *Flowers* in 3- or 4-flowered, axillary clusters, pedicels angular, 5—8 mm long, sparsely ferruginously sericeous. Outer sepals ovate, 3.5—4 by c. 2.5 mm, subobtuse, ferruginously tomentose on outside, glabrous on inside, inner sepals narrowly ovate, c. 3.5 by 1.5—2 mm, subacute, margins membranous and glabrous, fimbriate, otherwise similar to the outer sepals. *Corolla* 4—4.5 mm long, on outside ferruginously sericeous in middle-line of lobes and on tube, densely woolly tomentose in throat, lobes ovate-elliptic, c. 3.4—4 by 1.5—2 mm, rounded or obtuse at apex. *Stamens* 12, in 2 whorls, the epipetalous whorl longer than the alternipetalous, 2—2.5 mm long, filaments subulate, 1.5—2 mm long, glabrous, anthers c. 1.5 mm long, short obtusely acuminate, dehiscing extrorsely, glabrous. *Ovary* conoid, c. 1 by 1.5 mm, 6-celled, 12-lobed, cinnamomously tomentose. Style stout, 5—7 mm long, glabrous. *Fruits* unknown.

Type specimen: *Bell & Haniff s.n.* in K.

Distribution: Malaya (Kedah).

Kedah. Kedah Peak, c. 300 m alt.: *Bell & Haniff s.n.* (K), large tree, fl. March.

103. **P. cuneifolium** Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 279 — *P. cuneatum* (Blume) Vidal, Sinopsis Atlas, 1883, 31, t. 62, f. A, p.p.; Merrill, Phil. Bureau For. Bull. 1, 1903, 47; Merrill, Bur. Gvt Lab. Publ. 6, 1904, 14; Dubard, Bull. Mus. hist. nat. Paris 15, 1909, 382; Lam, l.c. 1925, 35, 254; Lam, l.c. 1927, 391 — *Dichopsis cuneata* (Blume) F.-Vill., Nov. App., 1880, 124, p.p. — *P. heterosepalum* Merrill, Phil. J. Sc. 10, 1915, 61; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 280; Lam, l.c. 1925, 38; Lam, l.c. 1927, 395.

Trees, c. 15 m high. Branchlets slender, 2—5 mm in diam., terete, ferruginously tomentose in the most apical part, otherwise glabrous and striate when dry; terminal cone 1—2.5(—5) mm long; stipules lanceolate, c. 1 mm long, apex acute, brownish tomentose on outside, glabrous on inside, caducous. *Leaves* conferted or subconferted at apex of branchlets, obovate-spathulate or obovate-orbicular, (3—)5—8(—12) by (1.5—)2—3.5(—5) cm, apex rounded or short obtusely and broadly acuminate, or cordate, base narrowly cuneate and tapering into, or sometimes abruptly narrowed into petiole, shortly decurrent; juvenile leaves glabrous above, scattered ferruginously tomentose below but denser so on the midrib, mature leaves glabrous on either side, coriaceous; midrib impressed above and distinctly crested usually in the basal part only, prominent below, secondary nerves (7—)8—11(—15) pairs, ascending at an angle of c. 80°, straight, archingly joined near the margins of the leaf, inconspicuous above, prominent below, tertiary nervation widely reticulate, parallel to the secondary nerves, sometimes one nerve more distinctly developed and also parallel to the secondary nerves, almost invisible above, distinct below. Petioles (6—)8—11(—13) mm, flat above, rugose in the basal part, glabrous. *Flowers* axillary, solitary or in clusters of 2—4, pedicels (6—)9—12 mm, angular, ferruginously tomentose, in fruit up to 15 mm long and stouter. *Sepals* 4 or 6, ovate, 2.5—3 by

c. 3 mm, ferruginously tomentose on outside, glabrous on inside, apex of outer sepals subacute, margins ciliate, apex of inner sepals obtuse and margins membranous and scarious, dorsally crested. *Corolla* 7—9 mm long, entirely glabrous or with a few hairs in the middle-line of each lobe, lobes ovate-elliptic, 5—6.5 by 2—2.5 mm, obtuse. *Stamens* 12, inserted at base of lobes, 4—5.5 mm long, filaments filiform, 2—3 mm long, angular, glabrous, anthers ovoid, 2.5—3 mm long, apex mucronate, dehiscing extrorsely, glabrous, in bud with few ferruginous hairs. *Ovary* ovoid, c. 2 by 2 mm, 6-celled, 6-lobed, ferruginously tomentose, borne by a thick disk. Style flagellate, 7—11 mm long, with 6 ribs, glabrous. *Fruits* globose, 2—3 cm in diam., when young ellipsoid and usually bearing a short remnant of the style, 1-seeded, pericarp fleshy, glabrous, with 3 broad white streaks (always?). Seeds unknown.

Lectotype specimen: *Vidal 440* in L.

Vernacular names: Philippines: arosap, anosep, malikinik, tañgiling-kompól (Tagalog), lako-lako (Pánay Bisáya); Borneo: ketiau.

Ecology: In primary and secondary forests at low and medium altitudes, or in swamps.

Distribution: Luzon, Mindoro, Guimares, Cebu, and perhaps in Borneo.

LUZON. Bulacan prov.: *Ramos 1998* (G, L, NY, SING), fr. Dec. — Rizal prov.: *Reillo 19160* (NY), fl. Dec., type specimen of *P. heterosepalum* Merrill; ibidem: *Loher 13875* (BO), tree, fl. Jan.; Montalban: *Loher 6555* (K), fl. — Zambales prov.: *Curran & Merritt 8245* (NY), fl. Nov./Dec.; Botolan: *Merrill 2993* (BM), fr. June; Tanauan: *Vidal 440* (FI, K, L), fl. April; ibidem: *Vidal 1561* (FI), fl. April; ibidem: *Vidal 1561* (FI), fl. April.

GUIMARES. without known loc.: *Gammill 238* (NY), fl. Jan.

PANAY. Ilo-Ilo prov., Mt Pulacan, Miagas: *Vidal 3184* (K), fl. & fr. March.

MINDORO. Paluan: *Ramos 39811* (L), fr. April; ibidem: *Ramos 39790* (L), fr. April.

CEBU. f. Merrill 1923, 279.

Without known loc.: *Loher 6553*, f. Lam, l.c. 1925, 38, 254.

BORNEO. Sarawak, Sibuan: *SAE 82692* (SAR), tree 26 m, May, dubious specimen; ibidem: *SAE 82714* (SAR), tree 29 m, May, dubious specimen.

Remarks. As no type specimen ever has been indicated neither by Villar, Vidal or Merrill, *Vidal 440* is chosen, as probably it was this specimen that Villar had in hands when ascribing it to *Dichopsis cuneata*.

The specific epithet *cuneata* used by Villar is derived from *Bassia cuneata* Blume. But as this represents a *Madhuca* and Villar misapplied that name to a species of *Dichopsis*, which subsequently was transferred by Vidal to *Palaquium*, Merrill was fully justified in replacing the specific epithet *cuneata* by *cuneifolium*, since *Palaquium cuneatum* (Bl.) Vidal is based on a synonym now referred to the genus *Madhuca*, viz *M. cuneata* (Bl.) McBride.

104. *P. pseudorostratum* H. J. Lam, l.c. 1927, 393, f. 3.

Trees, up to 45 m tall. Branchlets stout, terete or angular, 3—7 mm in diam., glabrous; terminal cone, if present, up to 5 mm long, ferruginously sericeous; stipules minute, very soon caducous. *Leaves* scattered, obovate, obovate-spathulate or spatulate, (3—)7—15 by 1.7—4 cm, apex rounded or obtuse, very rarely obtusely acuminate with the acumen up to 3 mm long, base narrowly cuneate, tapering along upper side of petioles;

glabrous on either side, thinly coriaceous; midrib grooved above and sometimes minutely crested as well, prominent and angular below, secondary nerves 13—20 pairs, but some of the tertiary nerves stronger developed and parallel to the secondary nerves and increasing the number of the latter up to 30, ascending at an angle of 75° — 85° , slender and prominulous on either side, sometimes very inconspicuous above, straight but curved at the very tips only, archingly joined very close to the margin or reaching to the edge and forming an indistinct almost straight intramarginal nerve, tertiary nerves parallel to the secondary nerves, inconspicuous, but sometimes as strongly developed as the latter, widely reticulate. Petioles 0.8—4 cm long, flat or crested above, angular below, initially ferruginously appressedly tomentose, ultimately glabrous. *Flowers* in 2—4-flowered clusters in the axils of the uppermost leaves and/or in the lower leaf scars, pedicels angular, 1.5(—7) mm long, ferruginously sericeous. *Sepals* ovate, 2—3.5 by 2—3 mm, obtuse or subacuminate, crested at the back, ferruginously appressedly tomentose or outside, glabrous within except along the apical margin, fimbriate, inner sepals slightly smaller than the outer ones, with membranous and glabrous, fimbriate margins. *Corolla* 5—7 mm long, glabrous except for a ring of ferruginous hairs at base of stamens, reflexed in anthesis, lobes elliptic-oblong, 3.5—5.5 by 1.5—2 mm, obtuse or truncate, and penicillate at apex. *Stamens* 12, in 2 whorls, the alternipetalous shorter than the epipetalous, 3—5 mm long, filaments filiform, 2—4 mm long, glabrous, anthers ovoid-lanceolate, 1.5—2 mm long, connective prolonged and obtuse or rounded, glabrous. *Ovary* ovoid, c. 1 by 1.5 mm, 6-celled, 12-lobed, glabrous in the basal part, ferruginously sericeous for the rest. Style filiform, 6—10 mm long, 6-grooved, glabrous. *Fruits* globose, ellipsoid, disciform or depressedly globose, 0.8—1.5 by 1.2—1.6 cm, 1—5-seeded, obtuse or rounded at apex, often with a short remnant of the style, which is circularly expanded at base, (2—)6- or 12-grooved, pericarp woody, glabrous. Seeds ellipsoid, up to 11 by 6 by 5 mm, testa black, nitidous, scar covering half of the seed, greyish, dull, embryo exalbuminous, radicle small, shortly exsert.

Type specimen: *NIFS bb 9449* in BO.

Vernacular names: bintagor batu, kandjak laki, nyatoh, njatoh batu, njato puntik.

Ecology: Growing in freshwater swamp forests, or on limit between Agathis forests and swampy forests, at low altitudes.

Distribution: Borneo and Philippines.

BORNEO. Sandakan, Kimanis For. Res., Sabak: *Aliho A 488* (KEP, L, SAN, SING), fr. April; Sipitang, W. ridge of Mt Lumaku, alt. 1500 m: *Wood SAN 16731* (A, BRI, K, KEP, L, SAN, SING), tree 33 m, fr. Sept.; Padas Swamp: *Melegrito 2795* (K, L, SAN), tree 20 m, fr. Febr. — Sarawak, Sungei Retus, Batang Igan: *Anderson 53* (KEP), fl. July; ibidem: *Anderson 60* (SIBU), fl. July; Kuching: *SAR A 371* (KEP), fr. Oct.; ibidem: *Hawitt S. 1, 3 & 5* (BM), fl. May; ibidem: *Haviland 2319* (SING), fl. Febr.; Lowa Kabang South P. F.: *Anderson 482, 572, 2678, 2797* (SAN), Febr.-May; ibidem: *Anderson S 497* (SAR), Nov.; ibidem: *Wan S 2759* (SAN), June; ibidem: *S 896* (SAN), Febr.; Baram: *Anderson S 3279* (SING), tree, Oct.; Triso Peninsula: *Anderson S 3165* (SING), tree, fr. Nov.; Dano For. Res.: *Anderson 108* (SIBU), tree, Nov.; ibidem: *Ragetti S 402* (KEP, SAN), Dec.; Sibul: *Anderson 1526* (SAN), Febr.; Kerangas along Limbang Rd.: *SAN S 1283* (SAN, SING), Febr.; Bintulu: *Drahman S 906* (SAR), tree 20 m, Sept.; Selapok: *Budin A 1286* (KEP),

Febr.; Kalabakan, WNW of Tawan, alt. 200 m: *Wood SAN A 15249* (A, BO, K, KEP, L, SAN, SING), trees 45 m, juv. fr. June — without known loc.: *Haviland & Hose 3485 F* (BM, K, L), fr. Nov. — Indonesian Borneo, Sampit: *NIFS bb 33045* (BO, L, SING), tree 33 m, fr. Sept.; ibidem: *Buwalda 7812, 7860* (BO, L, PNH), tree, fl. yellowish green, Sept.; ibidem: *NIFS bb 32424* (BO, L), tree 29 m, fl. Oct.; ibidem: *NIFS bb 32381* (= *Buwalda 4*) (BO, L), tree 30 m, fl. Sept.; ibidem: *Buwalda 47* (BO, L), tree 29 m, fl. yellow, fr. green, Oct.; Lower Dajak, Tuwanan: *NIFS bb 9449* (BO, L), fl. & fr., Oct.; E. Kutai, Sg Susuk Region, alt. 50 m, loam soil with coral limestone: *Kostermans 5685* (BO, L), tree 30 m, fl. white, July. PHILIPPINES. without known loc.: *Lay s.n.* (BM), fr.

105. *P. pseudocuneatum* H. J. Lam, l. c. 1927, 391, f. 2.

Trees, up to 34 m high. Branchlets slender, terete or angular, 2—3 mm in diam., sparsely ferruginously sericeous at the ultimate tip of branchlets only, soon glabrous; terminal cone up to 3 mm long, tomentose; stipules minute, very soon caducous. *Leaves* scattered or subconferted at tips of branchlets, spatulate or obovate, 4—11 by 1.5—4.5 cm, retuse, rounded or short obtusely acuminate at apex, narrowly cuneate at base, decurrent along sides of petioles; glabrous on either side, subcoriaceous; midrib with one or two narrow grooves above, prominent and angular below, secondary nerves, slender, 10—12 pairs, but by stronger developed tertiary nerves parallel to the secondary ones, seemingly up to 50, ascending at an angle of 60°—80°, at the base c. 90°, straight or slightly curved, archingly joined close to the margin and forming an almost straight intramarginal nerve, prominulous above, less stronger so below, tertiary nerves reticulate-parallel to the secondary nerves and often as strongly developed as the latter. Petioles 6—12 mm long, grooved above, and sometimes minutely crested as well, prominent and angular below, glabrous. *Flowers* in 2—4 flowered, axillary clusters, pedicels angular, 5—12 mm long, ferruginously tomentose. *Sepals* ovate, 3—4 by 2—3 mm, acute at apex, ferruginously sericeous on outside, glabrous on inside except along the margin and sometimes along the middle-line, inner sepals smaller than outer ones, all sepals reflexed in fruit. *Corolla* 3—4 mm long, on outside ferruginously pubescent on the tube and base of lobes, on inside ferruginously woolly between the stamens, lobes elliptic-oblong, 2—3 by 1—1.5 mm, truncate or rounded at apex, reflexed in anthesis. *Stamens* 12(—8), inserted at different levels, 2.5—3 mm long, filaments filiform, 1.5—2.5 mm long, scattered ferruginously woolly, anthers ovoid, 1—1.5 mm long, bifid at apex, glabrous, dehiscent extrorsely. *Ovary* ovoid, c. 1.5 by 1.5 mm, 6-celled, 6—12-lobed, ferruginously hirsute. Style cylindric-filiform, 2—4 mm long, 6-grooved, glabrous except for the base. *Fruits* globose but constricted at base, or ellipsoid, 1.5—1.9 cm in diam., or c. 1.9 by 1.4 cm, 1-seeded, pericarp fleshy, glabrous. Seeds obovoid, c. 12 by 6 by 5 mm, rounded at apex, subobtusate at base, testa thin, scar covering half the seed, embryo exalbuminous, radicle small, not exsert.

Type specimen: *Egon 340* (non 306) in BO.

Vernacular name: nyatoh kelalang, salanglang.

Ecology: Hilly land forests at low altitudes or in swamps.

Distribution: Borneo.

BORNEO. Sarawak, 6th Mile For. Res.: *Egon 340* (non 306, f. Lam) (BO, SAR), tree c. 20 m, fl. & fr. Sept.; ibidem: *Egon 978* (SAR), fl. Aug.; Daro 3rd Div.,

swamps: *Anderson S 2627* (SAR), tree 15 m, April; Sibuluan, swamps: *Anderson S 1768* (SAR), tree 22 m, May; Pulau Bruit: *Morshidi S 2680* (SAR), May; Loba Kabang South P. F.: *Anderson S 2685* (SAR), tree, May; Betong Saribas For. Res.: *Anderson 8542* (L, SAR), tree 20 m, fl. Aug.; Binatang distr., Pulau Bruit: *Anderson 9058* (L, SAR), tree 16 m, fl. Sept.; ibidem: *Samsi bin Tahir 9246* (L, SAR), tree 34 m, diseased fl. Oct.; ibidem: *Samsi bin Tahir 9256* (L, SAR), tree 32 m, fr. immature, Oct. — Brunei, Badas swamps: *Anderson S 2834* (SAR), small tree, June — Indonesian Borneo, Mempawah subdistr., Andjongang, alt. 10 m: *NIFS bb 14246* (BO), tree 19 m, May; Meliau subdistr., Dawak, alt. 50 m: *NIFS bb 12400* (BO), tree 30 m, fr. April.

106. *P. amboinense* Burek, Ann. Jard. bot. Btzg 5, 1886, 37; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 17; Lam, l. c. 1925, 38; Heyne, Nutt. Pl. Ned.-Ind., ed. 2, 2, 1927, 1232; Lam, l. c. 1927, 395; Heyne, l. c., ed. 3, 1, 1950, 1232 — *P. javense* Burek, l. c. 36, t. 10, f. 3, 4; Koorders & Valetton, Bijdr. Booms. Java 1, 1894, 143; Dubard, l. c. 1909, 18; Hallier, Rec. Trav. bot. Néerl. 15, 1918, 70; Koorders & Valetton, Atl. Baumart. 4, 1918, t. 610; Lam, l. c. 1925, 45; Lam, l. c. 1927, 397; Lam, in Backer, Noodfl. Java 7, 1958, Fam. 166; Heyne, l. c., ed. 2, 2, 1236; idem, ed. 3, 1, 1236 — *P. njatoh* Burek, l. c., 41 — *P. jambos* Pierre ex Dubard, l. c. 1909, 17 — *P. timorensis* Baillon, in msc. — *Sicchius mas* Rumphius, Herb. Amb., ed. 2, 3, 1750, 40, t. 21.

Trees, up to 40 m. Branchlets terete, 2—5 mm in diam., ferruginously or golden-ferruginously tomentose when young, glabrous when mature; terminal cone up to 7 mm long, ferruginously tomentose; stipules acicular, 1—2.5 by c. 1 mm long, ferruginously tomentose, caducous. *Leaves* scattered, subconferted or conferted at apex of branchlets, elliptic to subelliptic, obovate, or obovate-oblong, (5—)7—16 by 2.8—5.5 cm, apex acute, rounded or obtusely acuminate, acumen up to 5 mm long, base narrowly or broadly cuneate, shortly decurrent; glabrous on either side, subcoriaceous or coriaceous; midrib crested above, prominent and angular below, secondary nerves 8—16(—25) pairs, straight, ascending at an angle of c. 70°, forked at their tips and irregularly archingly joined, often grooved above, prominent below, tertiary nerves transverse but almost parallel to the secondary nerves and in the basal and apical part of the leaf reticulate-parallel to secondary nerves and often one of the nerves stronger developed, thus apparently increasing the number of secondary nerves up to 25 pairs, inconspicuous above, prominent below. Petioles 6—14 mm long, flat above and crested in the most apical part only, very minutely golden-ferruginously tomentose. *Flowers* solitary or in 2—6-flowered, axillary clusters, pedicels angular, 4—8 mm long, ferruginously tomentose. *Sepals* triangular or ovate, 2—3.5 by 2—2.5 mm, apex obtuse or subacute, sparsely minutely ferruginously tomentose on outside, glabrous on inside, inner sepals slightly smaller and thinner than the outer ones and with membranous margins. *Corolla* seen in bud only, c. 2.8 mm long, lobes elliptic-ovate, c. 2.5 by 2 mm, yellowish brownish woolly at the obtuse apex. *Stamens* 12, inserted at base of tube, c. 2 mm long, filaments subulate, 1—2.5 mm long, glabrous, anthers sagittate, 1.8—2.5 mm long, apex irregularly obtuse or acute, dehiscent laterally, ferruginously sericeous (according to Burek glabrous but this might apply to mature anthers). *Ovary* narrowly conoid, c. 1 by 1 mm, 6-celled, deeply 6-lobed, ferruginously tomentose. Style claviform, c. 2.5 mm

long, glabrous. *Fruits* oblong or ovoid-oblong, sometimes oblique, 3.6—5 by 1—1.8 cm, 1-seeded, pointed at both ends, apex with a rudiment of the style, glabrous (?). Seeds with a large broad scar, pointed at both ends, albumen none, radicle not exsert, punctiform.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Java: bedu, djenipino, gentiri, genitri, grawang, kawang, kedu, kemedu, klawang, santen, sepat; Kangean: katingan, klèsi, tatingan; Sumbawa: kantusu; Sula: sapirie; Morotai: tiwiring; Misool: nat; Amboina: siki ajër, siki batu, siki mérah, siki laki laki, siki perampuan; New Guinea: kema (Kokas), nu, segu (Karooon), kemanak (Mooi), sowgwa (Manikiong), senariga (Oransbari), hamom (Sentani), lou (Skou), bori, hoo, joo, jook, naneu, tiejiek (Tami).

Ecology: In lowland forests.

Distribution: Java, Bali, Kangean, Sula, Celebes, Sumba, Sumbawa, Timor, Weda, Morotai, Amboina, Misool, Kai, New Guinea, New Britain, Solomons.

JAVA. Bandjuwangi: *Teysmann s.n.* (BO, L), type specimen of *P. javense* Burck; ibidem: *Teysmann s.n.* (BO, L), type specimen of *P. njatoh* Burck; Penarukan, Wonedji: *NIFS Ja 2261* (BO), tree 15 m, March; ibidem, Kesambi-Kerep, alt. 20 m: *NIFS Ja 2294* (BO), tree 12 m, March; Blora, Sambong, alt. 150 m: *NIFS Ja 1818* (BO), tree 23 m, Dec.

BALI. Pulkan, alt. 300 m: *van Steenis 7718* (BO), fl. April; Buleleng, Sendang, alt. 100 m: *NIFS bb 21406* (BO, L), fl.

KANGEAN. f. Lam, l.c. 1925, 45.

SULA. Mangoli, along Wai Tamila, alt. 100 m: *NIFS bb 29914* (BO, L, SING); ibidem: *NIFS bb 29754* (BO, L, SING) — Sanana, Tobukoh, alt. 20 m: *NIFS bb 28788* (BO, L, SING), fl. Aug. — Sulabesi, without known loc.: *Hultstijn 409* (L).

CELEBES. Menado, Banggai, Balaang, alt. 5 m: *NIFS bb 31862* (BO, SING), March; ibidem, Poso, Pusungi, alt. 25 m: *NIFS bb 31583* (BO, SING), March; Palopo, alt. 100 m: *NIFS bb 33079* (BO, L), tree 35 m, Sept.

SUMBA. Djuli, alt. 250 m: *NIFS bb 15134* (BO, L), Febr.

SUMBAWA. Bisna, Adu, alt. 600 m: *NIFS bb 6930* (BO), tree 40 m, Oct.

TIMOR. Tafinisi, alt. 900 m: *NIFS bb 17588* (BO, L, SING), fl. July; without known loc.: *Riedel s.n.* (L, P), fr.

WEDA. Tiloppo, alt. 25 m: *NIFS bb 24834* (BO, L, SING), April; ibidem: *NIFS bb 24881* (BO, L, SING).

AMBOINA. Waai, alt. 30 m: *NIFS bb 26005* (BO, L, SING), fl. Sept.; without known loc.: *Teysmann s.n.* (BO, SING), type specimen of *P. amboinense* Burck.

KAI. without known loc.: *Jaheri 1432144* (BO, L).

MOROTAI. Tobelo, alt. 80 m: *NIFS bb 33843* (BO, L), tree 38 m, fl. May; Daigila Penins.: *NIFS 33732* (BO, L), tree 22 m, fl. yellow, April.

MISOOL. Salafen: *NIFS bb 14383* (BO), tree 15 m, June.

NEW GUINEA. Western New Guinea, Geelvink Bay distr., Andai: *Sugiyama s.n.* (BO), fl. buds; Amban-Kol: *NGBW 2239* (HOLL, L), fl. Jan.; *Oransbari*: *NGBW 2135* (HOLL, L), tree 35 m, fl. buds, Oct.; Sausapor, primary forest on clayey soil: *NGBW 3946* (HOLL, L), tree 30 m, Nov.; ibidem: *NGBW 4649* (HOLL, L), tree, 30 m; Rendani: *NGBW 2231* (HOLL, L), tree 41 m, fl. buds green; Meos Waar Island: *NGBW 1221, 1218, 1294* (HOLL, L), trees 17—25 m, fl. buds June, fr. June; Windos Waar Island: *NGBW 3337* (HOLL, L), tree 25 m, June; Numfur: *NGBW 594* (HOLL, L), tree 50 m, March; distr. Hollandia, Tami, E. of Hollandia: *NGBW 2797* (HOLL, L), tree 34 m, fl. buds May; Tami river mouth: *NGBW 2698* (HOLL, L), tree 38 m, fl. March; ibidem: *NGBW 2706* (HOLL, L), tree 32 m, fl. March; ibidem: *NGBW 2711* (HOLL, L), tree 42 m, fl. & juv. fr. March; ibidem: *NGBW 2720* (HOLL, L), tree, March; ibidem: *NGBW 2728* (HOLL, L), tree 36 m, March; ibidem: *NGBW 2805* (HOLL, L), tree 30 m, fl. buds June; ibidem: *NGBW 2807* (HOLL, L), tree 32 m, fl. buds June; Holtekang: *NGBW 815* (HOLL, L), tree 30 m, Jan.;

ibidem: *NGBW 1543* (HOLL, L), tree 32 m, Oct.; ibidem: *NGBW 1546* (HOLL, L), tree 43 m, Oct.; ibidem: *NGBW 1548* (HOLL, L), tree 35 m, Oct.; ibidem: *NGBW 1572* (HOLL, L), tree 20 m, Oct.; Babrongko, Lake Sentani: *NGBW 5287* (HOLL, L), tree 37 m, fl. buds green, April; Kokas, Ugar: *NGBW 3136* (HOLL, L), tree, June — Papua, Misima Island: *NGF 2774* (CAN, L, LAE), fl. buds June.

NEW BRITAIN. Jacquinot Bay: *Mair 142* (LAE), tree, Jan.; ibidem: *NGF 164* (L, LAE), Jan.; Keravat, alt. 130 m: *Womersley 7936* (L, LAE), tree 16 m, fl. buds, March; Open Bay, Nantambu: *Mair 1875* (LAE), tree 30 m, fl. May.

SOLOMONS. Bougainville, Torokina: *NGF 583* (L, LAE), March.

107. *P. galactoxylum* (F. Mueller) H. J. Lam, l. c. 1925, 107; Lam, l. c. 1927, 414 — *Bassia galactoxyla* F. Mueller, *Fragm. Phyt.* 6, 42, 1867, 27 and vol. 8, 55, 1870, 115 — *Galactoxylon pierrei* Baillon, *Hist. Pl.* 11, 1891, 300, *descr. fl. excl.* — *Sersalisia ? galactoxylon* F. Mueller ex Baillon, l. c., *descr. fl. excl.* — *Sersalisia galactoxylon* (F. Mueller) F. Muell. in *Bentham, Fl. Austr.* 4, 1869, 279 — *Lucuma galactoxyla* (F. Mueller) Bailey, *Qld. Flora* 3, 1900, 955.

Trees, up to 47 m. Branchlets slender, 3—6 mm in diam., with numerous scars of pedicels, ferruginously tomentose, glabrescent; terminal cone up to 9 mm long, ferruginously tomentose; stipules lanceolate-linear, up to 6 by 1 mm, acute at apex, tomentose on outside, glabrous on inside, caducous, sometimes long persistent. *Leaves* conferted at apex of branchlets, oblong-obovate or spatulate, 7—13.5 by 2.5—5 cm, apex rounded, emarginate, obtuse or rarely obtusely acuminate, acumen up to 5 mm long, base narrowly cuneate, decurrent along petioles; glabrous on either side, coriaceous; midrib grooved and minutely crested above, prominent and rounded, sometimes angular below, secondary nerves slender, 8—12(—16) pairs, ascending at an angle of c. 70°, curved, archingly joined, arches 2—3 mm from margin, prominulous on either side, sometimes grooved above, tertiary nerves few, slender, transverse, inconspicuous on either side or sometimes more distinct below, but often almost parallel to the secondary nerves. Petioles 3—15(—25) mm, grooved above, rugose and thickened in the basal part, ferruginously tomentose, but soon glabrous. *Flowers* in 2—4-flowered, axillary clusters along up to 3 mm long brachyblasts, pedicels angular, 6—7 mm long, ferruginously tomentose. *Sepals* ovate, 1.5—2.5 by 1.5—2.5 mm, apex obtuse, ferruginously tomentose on outside, glabrous on inside, inner sepals more rotundate than the outer ones, with membranous, glabrous, fimbriate margins. *Corolla* 6-lobed, c. 2.5 mm long, entirely glabrous, lobes ovate-oblong, c. 2 by 1 mm, rounded or obtuse at apex and fimbriate. *Stamens* 12, c. 1.5 mm long, filaments subulate, c. 0.5 mm long, glabrous, anthers sagittate, c. 1.5 mm long, acuminate, and fimbriate at tip, ferruginously hirsute on either side, dehiscing laterally. *Ovary* ovoid, c. 0.5 by 0.5 mm, 6-lobed, ferruginously hirsute. Style stout, subclaviform, c. 1.5 mm long, when mature c. 10 mm long, glabrous. *Fruits* obliquely ellipsoid, attenuate at either end, 2—3.5 by 1.5—2.5 cm, 1- or 2-seeded, apex subacute, base of style slightly widened, pericarp thin, fleshy, glabrous. Seeds ellipsoid, laterally compressed, c. 2 by 1.5 by 1 cm, rounded at either end, testa cartilaginous, thin, brownish yellow, glossy, scar covering slightly more than $\frac{1}{3}$ of the surface, brownish, dull, embryo exalbuminous, radicle short.

Type specimen: *Dallachy s.n.* in MEL.

Distribution: Australia, Solomons, New Britain, New Guinea.

Remarks. The addition by Pierre and Baillon of the details of the androecium seem to be derived from flowers not belonging to the genus *Palaquium* at all and it must be seriously doubted whether Pierre and Baillon matched the right flowers against the fruiting material. This doubt is increased by the fact that von Mueller did not describe the corolla and androecium and Bailey much later also did not give details. From all the material available at present it is clear that the flowers are entirely different from those described by Pierre and Baillon. The description here is therefore derived from the material quoted below, more in particular from the New Guinean material.

Var. *galactoxylum*

Petioles 3—8 mm long.

Type specimen: *Dallachy s.n.* in MEL.

Vernacular names: pencil cedar, moordooke (Queensland).

Ecology: In rainforests at low altitudes.

Distribution: Australia (Queensland).

Queensland, Rockingham Bay: *Dallachy s.n.* (BO, K, L, MEL, P), fr.; Cairns: *Mocatta s.n.* (BRI), Jan.; Mt Gribble: *Bailey s.n.* (BRI), fr. Nov.; North Kennedy distr., Jarra Creek, c. 13 miles NW of Tully, rainforest, alt. c. 50 m: *L. S. Smith & L. J. Webb 4905* (BRI), Nov.; Johnstone river: *Ladbrook s.n.* (BRI, NSW), Nov.

Var. *salomonense* (White) van Royen, nov. comb. — *P. salomonense* White, Journ. Arn. Arb. 31, 1950, 107.

Petioles 8—25 mm long.

Type specimen: *Walker & White BSIP 180* in BRI.

Vernacular names: New Guinea: taubabu (Koiari), joedag, djoerag (Asmat), tau-wa-salaina (Normanby).

Use: On Normanby Island used as posts in native houses.

Ecology: In periodically flooded lowland forests, in swampforests, or sometimes in dry rainforests.

Distribution: New Guinea, New Britain, Solomons.

NEW GUINEA. Western New Guinea, Asmat region, Erma, level land inundated in the wet season, primary forest: *Nautje 6538* (L), tree 20 m, June; ibidem: *Nautje 6533* (L), tree 28 m, immature fr., June; ibidem: *Nautje 6556* (L), tree 25 m, July; ibidem: *NGBI 6516* (L), tree 14 m, June — Northeastern New Guinea, Bumbu area near Lae: *Vickery 1402* (BRI, L, LAE), tree 45 m, fl. buds July; Lae: *Vickery 939* (L, LAE), tree, fr. Oct.; ibidem: *White, Dadswell & L. S. Smith 1739* (LAE), tree 40 m, fl. & juv. fr. green, Aug.; Yalu area, alt. 100 m: *Vickery 1424* (BRI, L, LAE), tree 47 m, fr. Nov.; Busu river near bridge: *NGF 5515* (CAN, L, LAE), tall tree, Febr.; Botanical Gardens, Lae: *Womersley s.n.* (CAN, L, LAE), fl. May; Wau Rd, west from Lae: *Womersley 4306* (BO, BRI, L, LAE, SING), tree 26 m, juv. fr. July — Southeastern New Guinea, Veiya, riverside swampforest: *Carr 11599* (BM, K, L, SING), tree 16 m, fl. buds March; Kokoda, alt. 400 m: *Carr 16496* (BM, CAN, K, L, SING), tree 30 m, fl. green, May; near Brown river bridge: *Jackson & McDonald 4571* (CAN, L, LAE), tree 26 m, Nov.; Normanby Island, Waikaiuna Plantation: *Jackson 4112* (BO, CAN, L, LAE, SING), tree, Jan.

NEW BRITAIN. Jacquinot Bay: *Haas 164* (BRI), tree 30 m, fl. buds Febr.

SOLOMONS. New Georgia: *Walker & White BSIP 180* (A, BO, BRI), tree 35 m, fl. Oct.

Remark. Though the difference between the two varieties seems

to be very slight, on account of its consistency, and on the distinct geographical separation, they are kept apart.

108. *P. brassii* H. J. Lam, n. sp. — Fig. 25.

Arbor magna. Ramuli teretes, brunneo-tomentosi, glabrescentes; stipulae lanceolatae, acutae, longe persistentes, sed ultimo caducae. Folia obovata, 4.7—8.3 × 2.2—3.7 cm, apice obtusa vel obtuse-acuminata, supra glabra, subtus costa ferrugineo-tomentosa excepta glabra. Nervii secundarii utroque latere 9—12, irregulariter arcuato-connecti, tertiarii reticulati, nervis secundariis paralleli. Petiolus 0.6—1.1 cm longus, ferrugineo-tomentosus. Pedicellus ferrugineo-tomentosus. Sepala 6, extus ferrugineo-tomentosa, intus glabra. Corolla glabra. Stamina 12; filamenta glabra; antherae sparse ferrugineo-puberulae. Ovarium 6-loculare, in parte apicali ferrugineo-puberulum ceterum glabrum; stylus glaber. Typus: *Brass 7024* in L.

Trees up to 30 m. Branchlets terete, 3—5 mm in diam., brownish tomentose, glabrescent; terminal cone up to 5 mm long, ferruginously tomentose; stipules lanceolate, 2—3.5 by 1—1.5 mm, apex acute, ferruginously tomentose on outside, glabrous on inside, rather long persistent but finally caducous. *Leaves* subconferted at apex of branchlets, obovate, 4.7—8.3 by 2.2—3.7 cm, apex obtuse or obtusely acuminate, base cuneate, shortly decurrent along adaxial side of petiole; glabrous above, glabrous below except ferruginously tomentose along midrib, subcoriaceous; midrib grooved above, prominent and rounded below, secondary nerves 9—12 pairs, ascending at angle of 70°—80°, straight, forked at apex and irregularly archingly joined rather far from the margins of leaf, slender, prominent on either side, tertiary nerves reticulate-parallel to secondary nerves, slender, prominulous on either side. Petioles 6—11 mm long, grooved above, ferruginously tomentose. *Flowers* solitary or in 2—5-flowered, axillary clusters, pedicels angular, 3—5 mm long, ferruginously tomentose. Outer *sepals* triangular, c. 2 by 2 mm, apex subacute, ferruginously tomentose on outside, glabrous on inside, inner sepals ovate, c. 1.5 by 1.5 mm, apex subacute, margins membranous and fimbriate, ferruginously tomentose without, glabrous within. *Corolla* 4.5—7 mm long, glabrous on either side, reflexed in anthesis, lobes ovate-oblong, 3—4.5 by 1.5—2 mm, apex obtuse. *Stamens* 12, 2.5—3.5 mm long, filaments filiform, angular, c. 1.5 mm long, glabrous, anthers sagittate, 1.2—1.5 mm long, apex acute, dehiscent introrsely, sparsely ferruginously hairy. *Ovary* disciform, c. 1 by 1 mm, 6-celled, 12-lobed, ferruginously puberulous in the upper third only. Style linear, 7—12 mm long, sulcate and twisted, glabrous. *Fruits* unknown.

Type specimen: *Brass 7024* in L.

Ecology: Common large canopy tree on lower ridges.

Distribution: New Guinea.

NEW GUINEA. Southeast New Guinea, Western Distr., Palmer river, 2 miles below junction Black river, alt. 100 m: *Brass 7024* (A, L), fl. June, large canopy tree to 30 m, trunk spurred at base.

Remarks. Apart from the flowers this species, which is named in honour of Mr L. J. Brass, well-known collector of New Guinean plants, resembles *P. fidjiense* but distinctly differs from that species by the longitudinal not transverse tertiary nerves. Its relation is undoubtedly with *P. cuneifolium* from the Philippines, from which it differs by the much smaller and more gracile flowers, the different shape of the ovary, the

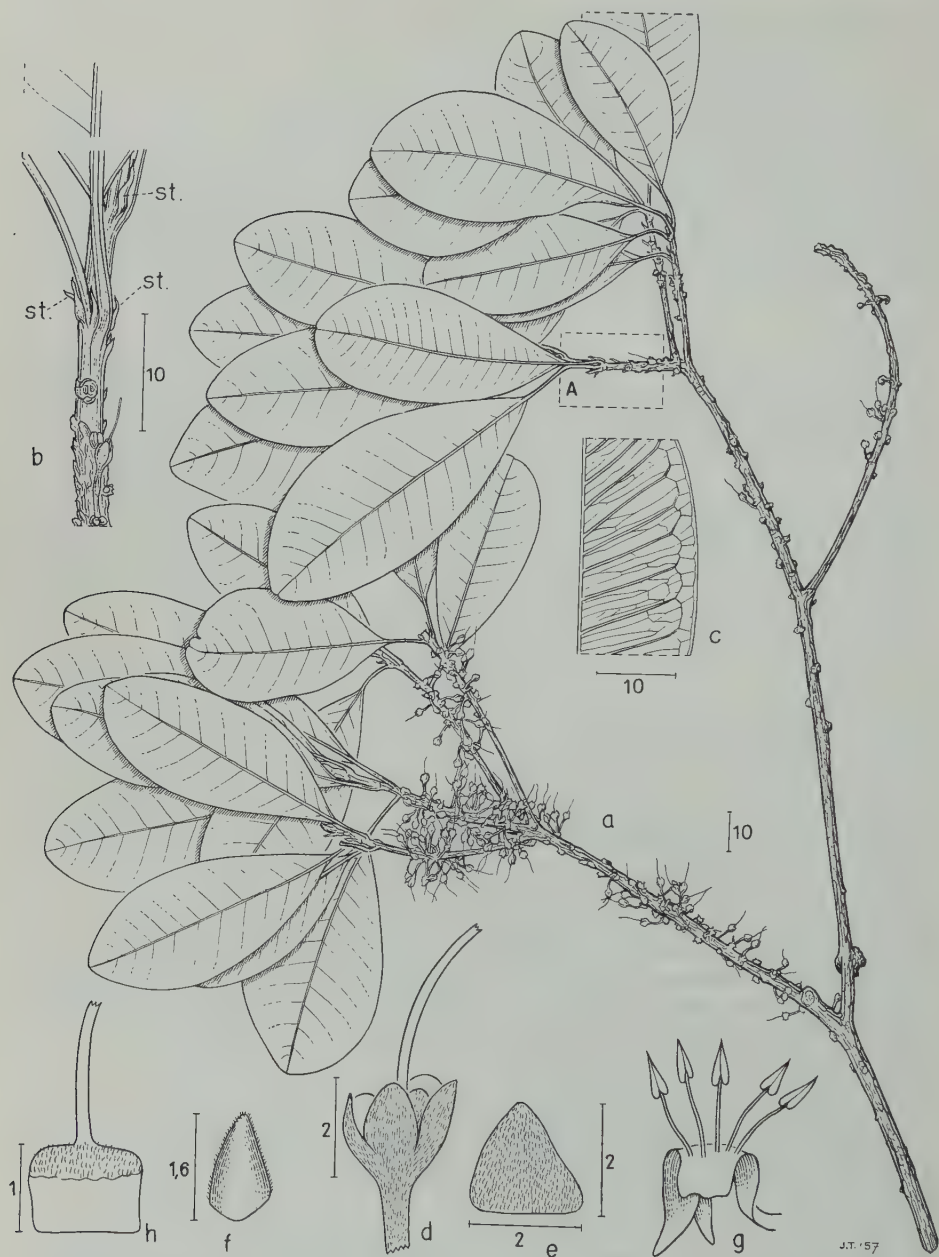


Fig. 25. *P. brassii*, a. branchlet with leaves and flowers (part A enlarged in b); b. branchlet with stipules (st); c. tertiary nervation of leaf; d. calyx and gynaecium; e. outer sepal, outside; f. inner sepal, outside; g. part of corolla, inside; h. gynaecium (Brass 7024, pubescence of the flowers in a. left out).

straight pedicels and style (both curved in *P. cuneifolium*) and the less rigid leaves.

109. *P. sumatranum* Burek, Ann. Jard. bot. Btzg 5, 1886, 34, t. 10 f. 9, 10; Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 1; Lam, l. c. 1925, 39, 254; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2, 1927, 1240; Lam, l. c. 1927, 396; Heyne, l. c., ed. 3, 1, 1950, 1240 — *P. teysmannianum* Burek, l. c., 38; Dubard, l. c. 1909, 17 — *P. beauvisagei* Burek, l. c., 38, t. 10 f. 7—8.

Trees, up to 45 m. Branchlets slender, 4—7 mm in diam., greyish or pale ferruginously puberulous, soon glabrous; terminal cone up to 13 mm long, puberulous; stipules lanceolate, 5—6 by c. 2 mm large, apex acute, puberulous on outside, glabrous on inside, caducous. *Leaves* scattered, elliptic- or obovate-oblong, (8—)14—22 by (2.5—)5—8 cm, apex rounded and usually obtusely acuminate, acumen up to 5 mm long, base narrowly cuneate, decurrent along lateral sides of petioles; glabrous, coriaceous; midrib grooved above, prominent and often angular below, secondary nerves 20—26 pairs, ascending at an angle of 60°—90°, straight, irregularly archingly joined close to the margin or diminishing until inconspicuous, prominent above, prominent below, tertiary nerves reticulate, parallel to secondary nerves, sometimes a few nerves transverse, prominent on either side. Petioles 1.6—3.5 cm long, grooved above or flat, slightly thickened in the basal half, dark reddish ferruginously or whitish puberulous, glabrescent. *Flowers* in 2—5-flowered, axillary clusters, pedicels angular, 5—10 mm long, in fruit 7—22 mm long, pale ferruginously or greyish puberulous, in fruit glabrous. *Sepals* ovate, 5—7.5 by 4.5—5.5 mm, apex subobtusate or acute, finely pale ferruginously or greyish puberulous on outside, glabrous on inside, inner sepals with membranous and ciliate margins. *Corolla* 6.5—8 mm long, glabrous except for the ferruginous pubescence of the central parts of the lobes, this pubescence soon disappearing, lobes elliptic or broadly ovate, 5—6 by 2.5—3.5 mm, apex rounded or subtruncate. *Stamens* 12, 5—6 mm long, entirely glabrous, filaments linear, 2.5—3.5 mm long, anthers oblong-ovoid, 2.5—3 mm long, apex acuminate, dehiscent extrorsely. *Ovary* disciform, c. 1 by 2 mm, pale ferruginously puberulous, 6-celled. Style subulate, 8—14 mm long, with 6 distinct stigmas at apex, glabrous. *Fruits* ovoid, ellipsoid or obovoid, 2.2—5 by 1.5—3 cm, apex rounded or acute, 1-seeded, pericarp fleshy, glabrous; seeds slightly smaller than fruit, rounded at apex, acute at base, black, nitidous, scar broadly elliptic, covering about $\frac{1}{4}$ of the surface of seed, grey, dull, embryo exalbuminous, radicle inferior, slightly exsert.

Type specimen: *Teysmann s.n.* in BO.

Vernacular names: Siam: pikul pah; Sumatra: madang sudu sudu, njato durian, meang na bontar, meang-rata, balam durian, balam sudu sudu, njato sudu sudu, gëtah, balam pipit; Borneo: njato gummy, njato katienu.

Ecology: In primary forests up to 1200 m alt.

Distribution: Siam, Sumatra, Riouw, Borneo, Billiton, Java.

SIAM. Trang, Ka-cha-wang, alt. 100 m: Boonkird 70 (L), tree, fl. greenish white, April.

SUMATRA. Indragiri Highlands, Danau Mangkuang, alt. 60 m: *NIFS* bb 27535 (BO, L), April; Pagarumbei, Tjenako river: *NIFS* bb 25795 (BO, L), Oct.; Taram, E of Pajakumbuh, on sandstone along river: *Meyer* 6721 (L), tree c. 20 m, Aug.; Palembang, Lematang Ilir, Semangus, alt. 100 m: *NIFS* bb 31748 (BO, L), June; ibidem, alt. 75 m: *NIFS* bb 32128 (BO, L), May; without loc.: *Teysmann* s.n. (BO, L, SING), fl., type specimen of *P. teysmannianum* Burek.

RIOUW. Lingga, Bukit Sei Sembilang, alt. 20 m: *NIFS* bb 32300 (BO, L, SING), fr. July.

JAVA. Cultivated in Hort. Bog.: *Kostermans* 9982 (BO, L), tree 45 m, fl. white, June, said to be a native of Java; ibidem: *Teysmann* s.n. (BO), found in Sumatra, type specimen of *P. beauvisagei* Burek.

BORNEO. Sandakan, Mt Kinabalu: *J. & M. S. Clemens* 40574 (G, K, L), tree 45 m, fl. brownish, white, Oct. — E. BORNEO, Sambas: *Beccari* s.n. (FI), fl. — S. E. BORNEO, Kutai: *NIFS* bb 14878 (BO, L), Dec.; ibidem, Pengatan: *NIFS* bb 14845 (BO), tree 28 m, Dec.; Tidung Lands, Numukan: *NIFS* bb 19788 (BO, L), fr. May.

BILLITON. Mt Banten: *van Alphen de Veer* s.n. (BO), May.

Remarks. Though Diepenhorst was the first who collected material of this species it is certain that the type specimen is derived from a tree cultivated in the Bogor Botanical Garden from seeds brought there by Diepenhorst and that Teysmann was the collector of the type specimen and not Diepenhorst as has been stated by Lam, l.c. 1925, 39.

In Lam's publications of 1925 and 1927, *P. beauvisagei* Burek is included in *P. javense* Burek, but a closer study reveals, however, that this is a later synonym of *P. sumatranum* rather than of *P. javense*.

The main difference between *P. javense* and *P. beauvisagei* is the smaller number of secondary nerves, (8—16(—25) against 20—26), the shorter petioles (6—14 against 16—35 mm), and the pubescent anthers in the former species. *P. javense*, finally, appeared to be identical with *P. amboinense* and so the two species are united.

The inclusion of *P. beauvisagei* in *P. sumatranum* geographically clarifies the situation as now *P. sumatranum* is found on Sumatra, Riouw, Borneo, and Billiton and *P. amboinense* from Eastern Java towards and including New Guinea.

Doubtful species

1. *P. ? annamense* Lecomte, Fl. Gén. Indo-Chine 3, 1930, 900.

Trees, up to 18 m. Branchlets terete, 3—5 mm in diam., glabrous; terminal cone and stipules unknown. Leaves conferted at apex of branchlets, spatulate or subobovoid, 8—10.5 by 3—3.5 cm, apex retuse, rounded or short obtusely acuminate, acumen up to 3 mm long, base narrowly cuneate, decurrent along sides of petioles; glabrous on either side; coriaceous; midrib grooved above, rounded below, secondary nerves 11—13 pairs, ascending at an angle of c. 60°, straight or slightly curved, stronger so at their tips, irregularly archingly joined, slightly grooved above, prominent below, tertiary nerves widely reticulate, inconspicuous and minutely grooved above, prominent below. Petioles 1—2 cm long, flat above, rounded below, thickened and rugose in the basal part, glabrous. Flowers unknown, pedicels in fruit stout, 2—2.5 cm long, glabrous, calyx in fruit 6-lobed, sepals triangular, 5—6 by 5—7 mm, apex obtuse, glabrous on either side. Fruits ovoid, 3—3.5 by 2—2.5 cm, 5—6-celled, 1-seeded, obtuse, pericarp

fleshy, with numerous papillae, glabrous. Seeds ellipsoid, 1.5—2.5 by 0.8—1.2 by 0.3—0.6 cm, testa thin, black, dull, scar as long as the seed, c. 2 mm wide, albumen none, radicle punctiform, not exsert.

Type specimen: *Poilane 1524* in P.

Distribution: Indo-China.

Remarks. The material of this species is rather poor and the insertion in this genus is rather uncertain.

2. *P. ? densivenium* Krause, Bot. Jahrb. 58, 1923, 469; Lam, Nova Guinea 14, 4, 1932, 552, t. 96.

No material of this species could be traced and provisionally the original description by Krause must serve as such:

Arbor alta erecta ramis crassis validis summo apice sparse puberulis cortice brunneo obtectis. Folia ad ramorum apices conferta; petiolus crassus semiteres supra applanatus, late canaliculatus, 1.8—2.8 cm longus, puberulus; lamina rigida supra glabra subtus dense ferrugineo-sericeo-pilosa, obovato-oblonga vel obovato-spathulata, apice breviter indistincte acuminata vel obtusata, basin versus longe sensimque angustata, 2.5—3.5 dm longa, tertio vel quarto superiore usque ad 1.5 dm lata, nervis lateralibus primariis c. 20 a costa valida subtus valde prominente patentibus prope marginem arcuatim adscendentibus supra impressis subtus prominentibus inter se venis transversis numerosis conjunctis percursa. Flores fasciculati; pedicelli breves 1—2 cm longi, sericeo-pilosi; calycis laciniae ovatae stamina nondum nota; ovarium subhemisphaericum, 3 mm altum, stylis glaber 2 cm vel ultra longus.

"Type specimens". *Schlechter 16200, Schultze 43* in B?

Distribution: New Guinea.

Northeastern New Guinea, Kelel, forests, alt. 200 m: *Schlechter 16200*, sterile; Kohari Mts, c. 800 m alt.: *Schultze 43*, fl. Aug.

Remarks. According to Lam, 1932, *Schlechter 16200* has leaves similar to *Planchonella kaernbachiana*, but judging from Krause's description he still regards this species as belonging to *Palaquium*.

3. *P. ? payeni(-ae)folium* Pierre in Beccari, Nelle For. di Borneo, ed. 1, 1902, 602; Lam, l. c. 1925, 106.

No type specimen nor description is indicated and no material which might be regarded as a type specimen turned up during the study of the genus.

4. *P. ? retusum* Beccari, Nelle For. di Borneo, ed. 1, 1902, 560.

Though a small description in Italian is given by Beccari no specimen is indicated that can serve as a base of this species. A search for specimens in the Florence material also proved to be negative. If, however, material turns up of this species the name will be valid since *P. retusum* is used by Merrill in 1909, and that species is renamed into *P. globosum* H. J. Lam.

5. *P. ? tenuifolium* Krause, Bot. Jahrb. 58, 1923, 472; Lam, Nova Guinea 14, 4, 1932, 553, t. 98.

No fertile material has been traced of this species and the original description by Krause must serve as such:

Arbor erecta ramis teretibus modice validis glabris vel summo apice sparse tomentosulis cortice obscure brunneo obtectis. Foliorum petiolus supra applanatus atque canaliculatus, 1.2—1.8 cm longus; lamina tenuiter chartacea utrinque glabra oblonga vel elliptica rarius obovato-oblonga, apice acumine abrupto oblongo obtuso 1—1.4 cm metiente praedita, basi subacuta, 1.6—2 dm longa, 7—9.5 cm lata, nervis lateralibus primariis 7—9 supra prominulis subtus distincte prominentibus angulo fere recto a costa patentibus marginem versus arcuatis percursa. Flores ignoti.

"Type specimens": *Schlechter 12745* and *Stephan 6*.

Distribution: New Britain, New Ireland, Kai Islands ?

NEW BRITAIN. near Massawa: *Schlechter 12745* in BO.

NEW IRELAND. near Muliama: *Stephan 6* in B ?

KAI ISLANDS. cult. in Hort. Bog. (BO), sterile.

6. *P. ? vidalii* Pierre ex Dubard, Bull. Mus. hist. nat. 15, 1909, 381; Merrill, Enum. Phil. Fl. Pl. 3, 3, 1923, 283; Lam, l. c. 1925, 106; Lam, l. c. 1927, 413.

As no material of this species could be found the original description is given here:

Folia elliptica, oblonga, 16 cent. longa, 6 cent. 5 lata, supra glabra, infra puberula, coriacea, 25—30 costulis, nervis transversaliter dispositis. Sepala 6, biseriata, 3 millim. 5—4 millim. alta, deltoidea, acuta, intus glabra, dorso squamuloso-puberula. Corolla adulta, extus sericeo-pilosa, intus glabra, tubo 4 millim. alto, lobis 8 millim. longis, reflexis, staminibus subaequilongis, crassis. Stamina 12, biseriata, exteriora paululo longiora epipetala, filamentis 5 millim. longis, interiora episepala filamentis 4 millim. longis. Antherae 4 millim. 5 altae, extrorsae, profunde cordatae, oblongae, lanceolatae, connectivo brevi denticulato vel apice biserurio, utrinque pilosae. Ovarium 6 loculare pyramidale, 2 millim. altum, basi disco pulvinato suffultum, cum stylo exserto, glabro, subulato, 18 millim. longo.

Type specimen: *Vidal 9* in P ?

Distribution: Philippines.

Excluded species

1. *P. angustifolium* Merrill, Bur. Gvt Lab. Bull. 17, 1904, 45 = **Planchonella firma** (Miq.) Dubard, Lam l. c. 1925, 202.

2. *P. beccarii* Pierre ex Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, p. 20; Lam, l. c. 1925, 47; Lam, l. c. 1927, 398 = **Aulandra beccarii** (Pierre) van Royen, Blumea, Suppl. IV, 1958, 263, f. 1.

3. *P. boninense* Nakai, Rigakkwai 26, 1928, 11 = **Planchonella ? boninensis** (Nakai) Masamuna & Yanagihara, Transac. Nat. Hist. Soc. Formosa 31, 1941, 322.

4. *P. nadeaudi* Drake, Fl. Polyn. Franc., 1891, 120 = **Nesoluma nadeaudi** (Drake) Pierre ex H. J. Lam, Occ. Papers Bishop Mus. Honolulu 14, 1938, 154.

5. *P. neocaledonicum* Moore, J. Linn. Soc. 45, 1920, 353 = **Pycnandra neocaledonica** (Moore) Vink, Nova Guinea N. S. 8, 1, 1957, 116.

6. *P. sussu* Engler, Notizbl. Berl. 1, 1895, 101 = **Planchonella sussu** (Engler) H. J. Lam, Nova Guinea 14, 4, 1932, 564, t. 119.

7. *P. ? species*, Lam., l. c. 1925, 107 — *Bassia elongata* Miquel, Fl. Ind. Bat. Suppl., 1860, 582; Burek, Ann. Jard. bot. Btzg 5, 1886, 46; Ridley, Fl. Mal. Pen. 2, 1923, 272 — *Illipe elongata* (Miquel) Engler, Bot. Jahrb. 12, 1890, 509 = *Trigonostemon* sp. (Euphorbiaceae).

Index of collectors' numbers

The numbers between brackets indicate the number of the species in the text. Those with the prefix D. or E. indicate the number of the doubtful or excluded species. S.n. means specimen without number.

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Addendum

P. 552, to 80. **P. vitilevuense** Gilly.

Remark. The description of this species apparently has never been published by Gilly, though from the annotations on the material in New York and Kew it was intended. To validate it a short latin diagnosis is given below.

Arbor. Folia elliptico-oblonga, 10—20 × 3.5—4.5 cm, apice rotundata vel obtusa, glabra sed costa subtus excepta. Nervii secundarii utroque latere 17—25, sursum evanescenti, tertiarii transversii. Petiolus 1.5—2 cm longus, ferrugineo-lanatus. Sepala late ovata, extus ferrugineo-lanata, intus glabra. Corolla glabra. Stamina 12, filamenta glabra; antherae utroque latere ferrugineo-tomentosa. Ovario 6-loculare, ferrugineo-pubescent; stylus glaber. Fructus ignotus. Typus: *Greenwood 914* in NY.

REVISION OF *ABRUS* ADANSON (PAP.) WITH SPECIAL REFERENCE TO AFRICA

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(Issued 1. XII. 1960)

Abrus is a small natural genus of the family *Papilionaceae*, containing four species, well distinguished by the presence of 9 connate stamens. As a genus it was first described by Adanson in 1763 who based it on *Glycine abrus* L. In fruit this species is easily distinguished by its conspicuously red and black coloured seeds, which are used in various ways, e. g. as beads in rosaries and necklaces, for making poison and medicine.

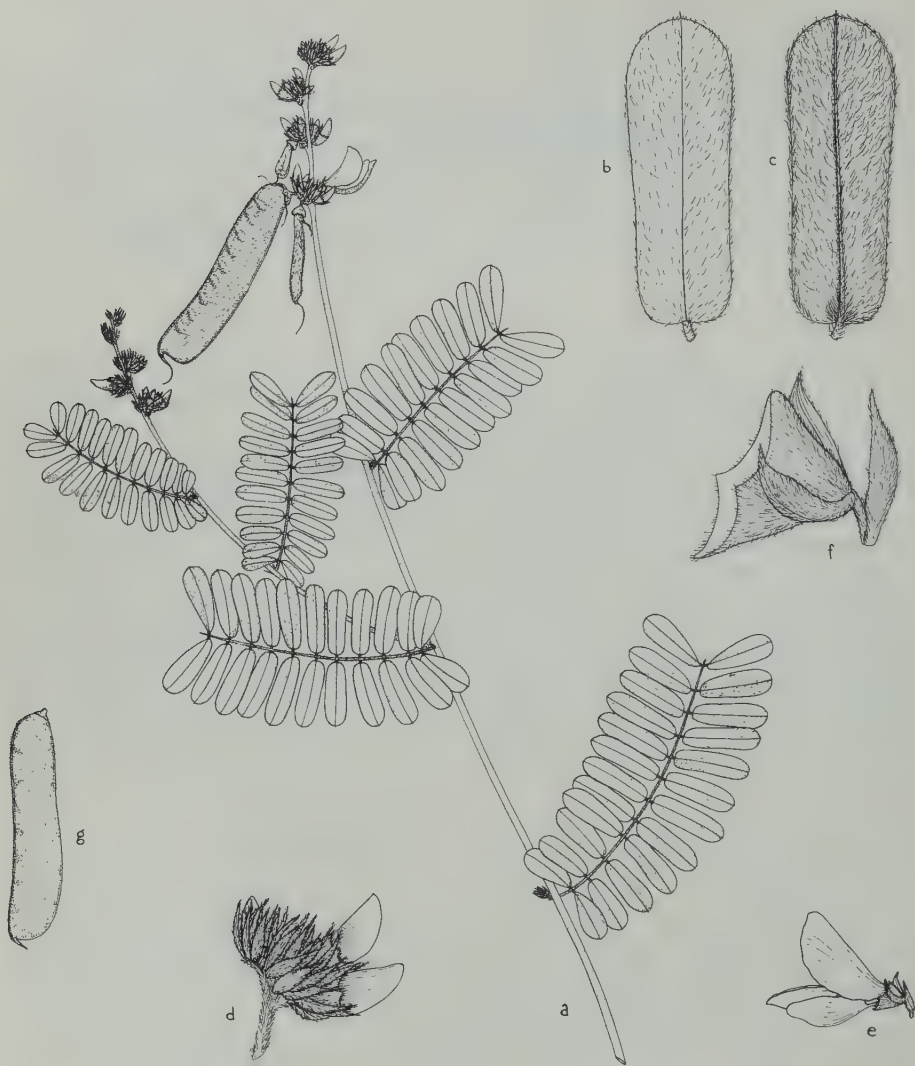
The flowers of the species in *Abrus* do not show any character leading to specific segregation. Characters of the pod and inflorescence are more useful. One, imperfectly known, species is recorded only from Madagascar and another is confined to tropical Africa. The other two species have a circumtropical distribution, one of these, *A. fruticosus*, is widely variable in habit, in the shape of the leaves, and in the indumentum. It is not advisable to segregate the different forms of this species, which were formerly described as distinct species (such as *A. schimperi*, *A. cantoniensis*, *A. mollis*, etc.), as infraspecific taxa, e. g. as varieties, or as name-bearing forms.

At the end of the present paper a list is given of representative specimens, for each species arranged in alphabetical order according to the collector's name.

I acknowledge my indebtedness to Prof. Dr. H. C. D. de Wit who helped me in various ways. I am also indebted to the Directors or Keepers of the following Herbaria for the loan of specimens, or for making specimens available for examination, or supplying information: Berlin (B), Brussel (BR), Coimbra (COI), Firenze (FI), Genève (G), Kew (K), Leiden (L), Lisboa (LISC), London (BM), München (M), Paris (P), Porto (PO), Pretoria (PRE), Utrecht (U), Wageningen (WAG), Wien (W), and Zürich (Z).

Abrus Adanson

Adanson, Fam. 2: 327. 1763; Linnaeus, Syst. 2: 472. 1767; Gen. Pl.: 365. 1778; DC., Prod. 2: 381. 1825; Wight & Walker-Arnott, Prod. 1: 236. 1834; Miquel, Fl. Ind. Bat. 1: 158. 1855; Bentham in Martius, Fl. Bras. 15(1): 215. 1859; Grisebach, Fl. Br. W. Ind. Isl.: 190. 1859; Harvey in Harvey & Sonder, Fl. Cap. 2: 262. 1862; Bentham, Fl. Austr. 2: 270. 1864; Bentham & Hooker, Gen. Pl. 1(2): 527. 1865; Baker in Oliver, Fl. Trop.



2

Fig. 1. *A. canescens* Welw. ex Bak.. a: flowering branch ($\times \frac{1}{2}$); b: upper surface of leaflet; c: lower surface of leaflet ($\times 2$); d: part of inflorescence ($\times 2$); e: flower ($\times 1$); f: calyx with bract and bracteoles ($\times 5$); g: pod ($\times \frac{1}{2}$) (a—f after Espirito Santo 3116; g after Michel 2822).

Afr. 2: 174. 1871; in Hooker, Fl. Br. Ind. 2: 175. 1876; Blanco, Fl. Fil. 2: 360. 1879; Boerlage, Handl. Fl. Ned. Ind. 1(2): 367. 1890; Taubert in E. & P., Pflanzenfam. 3(3): 355. 1894; Engler, Pflanzenw. Ost Afr. C: 219. 1895; Gagnepain in Lecomte, Fl. Gen. Indo-Chine 2: 357. 1916; Ridley, Fl. Mal. Pen. 1: 558. 1922; Baker f., Legum. Trop. Afr. 2: 350. 1929; Pellegrin, Legum. Gabon: 210. 1948; Phillips, Gen. S. Afr. Flow. Pl.: 421. 1951; Boutique in Fl. Congo Belg 6: 82. 1954.

Glycine L., Sp. Pl.: 753. 1753 (p.p. quoad *G. abrus* L.).

Hoefpneria Vatke, Oesterr. Bot. Zeitschr. 29: 222. 1879 (type species: *H. africana* Vatke (see under *A. fruticosus* Wall. ex W. & A.)).

Woody climbers, winding or not and then prostrate and assuming the habit of shrubs or undershrubs. Leaves paripinnate, multijugate; rhachis grooved, mucronate; leaflets opposite, mucronate; stipellae minute, subulate. Stipules mostly small, persistent.

Inflorescence terminating (apical and/or lateral) leafy or leafless branches, leafless branches bearing stipules, the leaves being either early shed or not developed. Flowers \pm sessile, aggregated on short, club-shaped or elongated, wart-like outgrowths (these outgrowths at the base very often supported by stipules of which the leaves are early shed or obsolete); bracts and bracteoles mostly small, often caducous. Calyx campanulate or funnel-shaped, lobed or short-toothed. Corolla much longer than the calyx; standard ovate-orbicular, notched at the apex, with a short claw; wings oblong-falcate, relatively long-clawed; keel longer than the wings. Stamens 9, monadelphous, the staminal tube at the base adnate to the standard; anthers uniform. Ovary \pm sessile, oblong, multiovulate, pubescent; style curved, \pm glabrous, mostly persistent; stigma penicillate.

Pods oblong or linear, bulgy or flattened, septate, beaked, pubescent. Seeds ovoid or laterally compressed, arillate.

Type species: *Abrus precatorius* L. (*Glycine abrus* L.).

Distribution: Four species, circumtropical.

Note: Adanson (l.c.) first published the name *Abrus* for a genus. He made no combination for the species intended as a base for the genus. The combination *Abrus precatorius* was made by Linnaeus in 1767 (l.c.).

Key to the species

- 1.a. Inflorescence mostly stout, rigid and strongly falcate. Pod bulgy, 2—3.5(5) cm long, 1—1.5 cm wide, mostly truncate at both ends. Seeds ovoid, scarlet with a black spot around the hilum 4. *A. precatorius*
- b. Inflorescence often slender, straight or slightly curved. Pod flat, or only slightly bulging over the seeds, outline less abruptly curved at both ends, mostly relatively narrower. Seeds laterally compressed, entirely brown-black 2
- 2.a. Bracts and bracteoles as long as or longer than the calyx 1. *A. canescens*
- b. Bracts and bracteoles up to half as long as the calyx 3
- 3.a. Leaflets 3—5 pairs, the upper ones lanceolate, 4.5—5.5 cm long, 1—1.5 cm wide 2. *A. diversifoliolatus*
- b. Leaflets (5)6—20 pairs, the upper ones usually smaller 3. *A. fruticosus*

1. *A. canescens* Welw. ex Baker — Fig. 1.

Baker in Oliver, Fl. Trop. Afr. 2: 175. 1871; Harms in Mildbraed, Wissensch. Ergebn. Deutsch. Zentr.-Afr.-Exp. 1907—1908 2: 263. 1911; Fl.

W. Trop. Afr. 1(2): 412. 1928; Baker f., Legum. Trop. Afr. 2: 351. 1929; Pellegrin, Legum. Gabon: 211. 1948; Robijns, Fl. Spermat. Parc Nat. Albert 1: 339. 1948; Tisserant, Cat. Fl. Oubangui-Chari: 91. 1950; Andrews, Flow. Pl. Sudan 2: 169. 1952; Boutique in Fl. Congo Belge 6: 83. 1954; Berhaut, Fl. Sénégal: 31. 1954; Fl. W. Trop. Afr. 1(2): 574. 1958.

Winding climber with woody pubescent branches, finally glabrescent. Stipules small, oblong-lanceolate. Leaves short-petiolate, 10—14-jugate; leaflets \pm rectangular, (6)10—20(30) mm long, 2—7(10) mm wide, white- or grey-pubescent on both sides, hairs often curved.

Inflorescences mostly terminal; flowers subsessile, usually in separated fascicles or pseudo-whorls; bracts and bracteoles as long as or longer than the calyx, (3)4—6 mm long, linear or lanceolate, acute. Corolla mostly purple, 10—15 mm long.

Pods broadly linear, nearly straight, (3.5)4—5.5(6) cm long, 8—12 mm wide, pubescent, 6—9-seeded, beak recurved, hook-shaped. Seeds ovate, 4—6 mm long, 3—4 mm broad, light brown-black, glossy.

Holotype: Angola, Pungo Andongo, Welwitsch 2250 (BM).

Distribution: Tropical Africa (no records seen from: Sénégal, Northern- and Southern Rhodesia, Nyasaland, Mozambique, Tanganyika, Sudan, Ethiopia, and Somalia).

Ecology: Climbing on trees, shrubs, or herbs in orchard- and shrub savannah, or twining over grass; often in marshy localities.

2. *A. diversifoliolatus* Breteler nom. nov. — Fig. 2: I.

A. acutifolius Viguier (non Blume ex Miquel), Not. Syst. 14: 173. 1952.

A climber with terete slender glabrescent branches. Leaves 3—5-jugate; petiole up to 2 cm long, pubescent; rachis 1.5—4 cm long, pubescent. The lower pair of leaflets ovate-elliptic, mostly 1—2 cm long, \pm 1 cm wide, obtuse or subcordate at the base, apiculate or acute at the apex; the upper pair of leaflets lanceolate, 4.5—5.5 cm long, \pm 1.5 cm wide, rounded and unequal-sided at the base, acute at the apex; all leaflets glabrous above, sparsely appressed-pubescent beneath.

Inflorescence straight or nearly so; bracts and bracteoles minute. Calyx pubescent. Corolla 3—5 times as long as the calyx, pale purple.

Pods unknown.

Type: Madagascar, Maromandia, "lieux cultivés", Decary 1635 (P: holotype; L: isotype).

Note: The name *A. acutifolius* Viguier (1952) was preceded by *A. acutifolius* Blume ex Miquel (Fl. Ind. Bat. 1: 160. 1855), and had to be replaced by a new name.

Fig. 2: I. *A. diversifoliolatus* Bret., a: flowering branch ($\times \frac{1}{2}$); b: lower surface of leaf ($\times \frac{1}{2}$) (after Decary 1635: isotype (L)). II. *O. fruticosus* Wall. ex W. & A., A form formerly described as *A. schimperii* Hochst. ex Bak., a: flowering branch ($\times \frac{1}{2}$); b: upper surface of leaflet ($\times 1$); c: lower surface of leaflet ($\times 1$) (after Schimper 1552).



3. *A. fruticulosus* Wall. ex W. & A. — Figs. 2: II; 3; 4.

Wight & Walker-Arnott, Prod. 1: 236. 1834; Baker in Hooker, Fl. Br. Ind. 2: 176. 1876. — *A. laevigatus* Meyer, Comm. 1(1): 126. 1836; Harvey in Harvey & Sonder, Fl. Cap. 2: 263. 1862; Merrill, Enum. Phil. Flow.

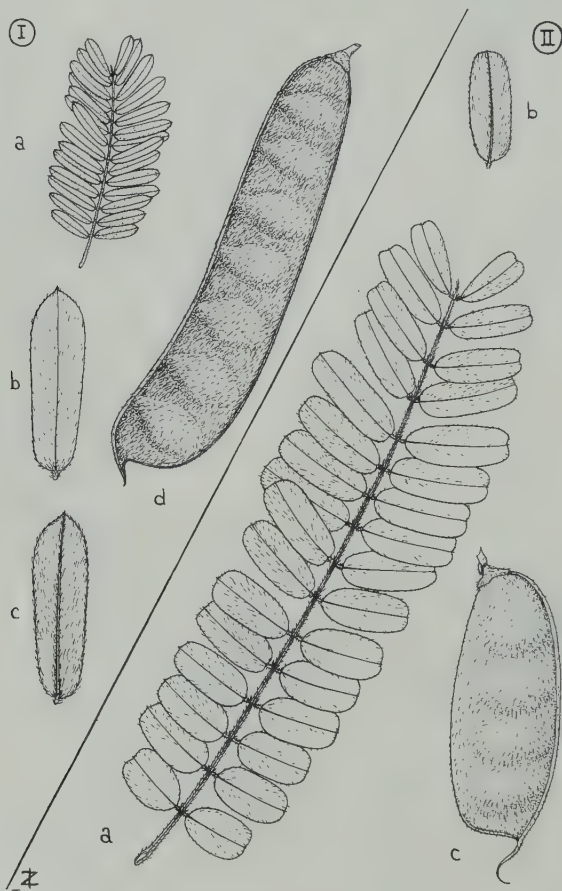
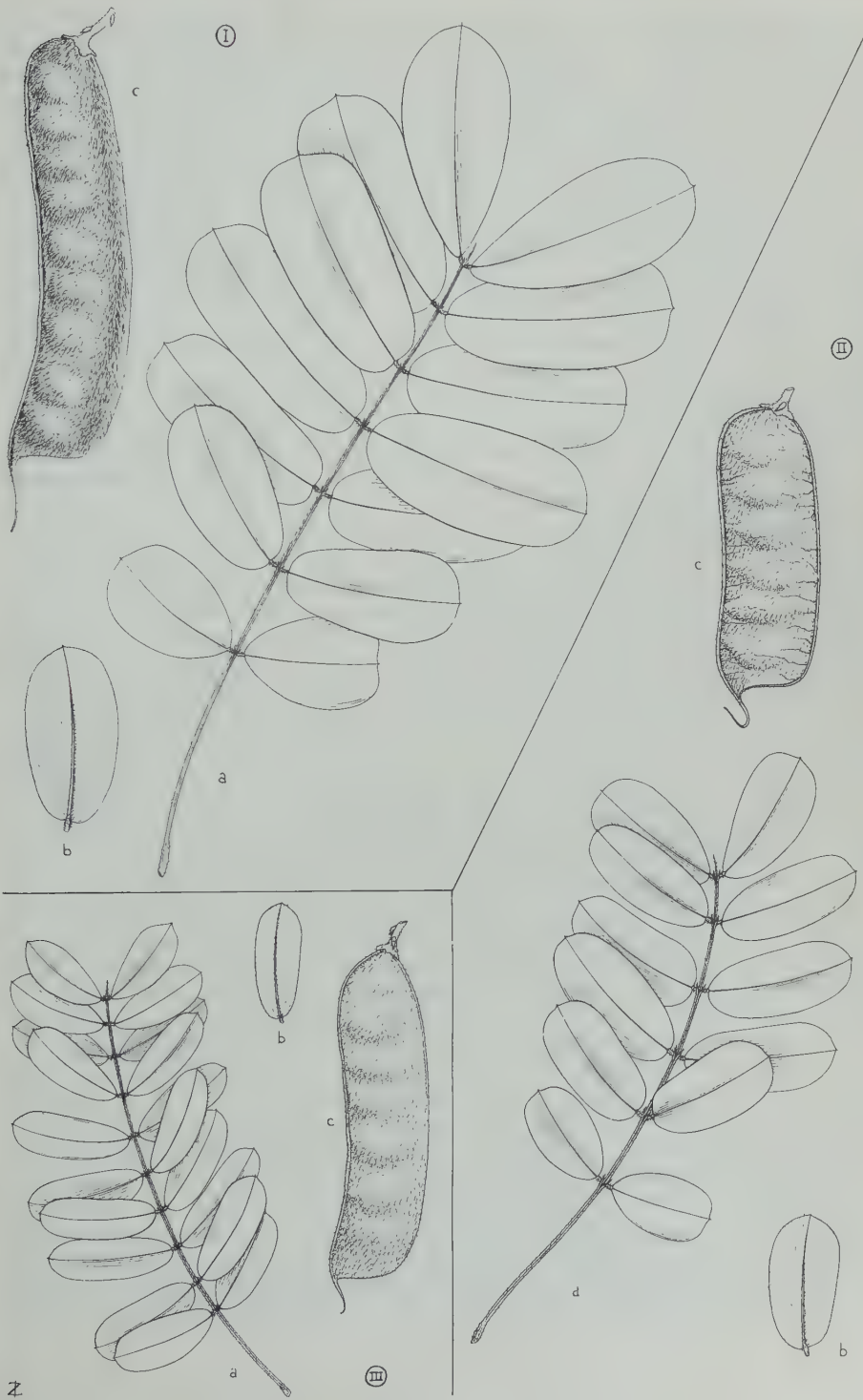


Fig. 3. *A. fruticulosus* Wall. ex W. & A.. I. a: leaf ($\times 2$); b: upper surface of leaflet ($\times 6$); c: lower surface of leaflet ($\times 6$); d: pod ($\times 2$) (after Wight 827). II. A form formerly named *A. suffruticosus* Boutique. a: leaf ($\times 2$); b: lower surface of leaflet ($\times 2$); c: pod ($\times 2$) (after Fanshawe 1015 and Quarré 1044).

Fig. 4. *A. fruticulosus* Wall. ex W. & A.. Three forms formerly named either *A. pulchellus* Wall. ex Thw. or *A. laevigatus* Meyer. a: leaf ($\times 1$); b: lower surface of leaflet ($\times 1$); c: pod ($\times 1$) (I after Espirito Santo 3647; II after Barbosa 180; III after Barbosa 1339).



Pl. 2(5): 303. 1923; Baker f., Rev. Zool. & Bot. Afr. 21: 303. 1932; Backer, Fl. Java 5: 114. 1941. — *A. melanospermus* Hasskarl, Cat. Bog.: 228. 1844; Miquel, Fl. Ind. Bat. 1: 159. 1855. — *A. acutifolius* Blume ex Miquel, l. c.: 160. — *A. tenuiflorus* Spruce ex Benthham in Martius, Fl. Bras. 15 (1): 216. 1859. — *A. pulchellus* Wall. ex Thwaites, Enum. Pl. Zeyl.: 91. 1859; Harvey, l. c.: 263 (in adnot.); Baker in Oliver, Fl. Trop. Afr. 2: 175. 1871; in Hooker, Fl. Br. Ind. 2: 175. 1876; Taubert in E. & P., Pflanzenfam. 3 (3): 355. 1894; Engler, Pflanzenw. Ost Afr. C: 219. 1895; Koorders, Exk. Fl. Java 2: 397. 1912; Gagnepain in Lecomte, Fl. Gen. Indo-Chine 2: 359. 1916; Ridley, Fl. Mal. Pen. 1: 558. 1922; Fl. W. Trop. Afr. 1(2): 412. 1928; Baker f., Legum. Trop. Afr. 2: 351. 1929; Rev. Zool. & Bot. Afr. 21: 303. 1932; Tisserant, Cat. Fl. Oubangui-Chari: 91. 1950; Andrews, Flow. Pl. Sudan 2: 169. 1952; Berhaut, Fl. Sénégal: 30. 1954; Boutique in Fl. Congo Belge 6: 84. 1954; Fl. W. Trop. Afr. 1(2): 574. 1958. — *A. pulchellus* Wall. f. *latifoliolata* De Wildeman, Ann. Mus. Congo Belge, Bot., sér. 5(1): 150. 1904; l. c., sér. 5(2): 153. 1907. — *A. pulchellus* Wall. var. *latifoliolata* De Wild., l. c., sér. 5(1): 267. 1906. — *A. pulchellus* Wall. var. *latifoliolatus* De Wild., Th. & H. Durand, Syll. Fl. Cong.: 146. 1909; De Wildeman, Et. Fl. Bang. & Ub.: 326. 1911. — *A. pulchellus* Wall. f. *typica* & f. *melanosperma* Backer, Fl. Java: 354. 1911. — *A. cantoniensis* Hance in Seemann, Journ. Bot. 6: 112. 1868; Gagnepain in Lecomte, Fl. Gen. Indo-Chine 2: 358. 1916. — *A. mollis* Hance in Seemann, Journ. Bot. 9: 130. 1871; Gagnepain, l. c.: 360. — *A. schimperi* Hochst. ex Baker in Oliver, Fl. Trop. Afr. 2: 175. 1871; Taubert in E. & P., Pflanzenfam. 3 (3): 355. 1894; Engler, Pflanzenw. Ost Afr. C: 219. 1895; Baker f., Legum. Trop. Afr. 2: 352. 1929; Tisserant, Cat. Fl. Oubangui-Chari: 92. 1950; Andrews, Flow. Pl. Sudan 2: 169. 1952; Cufodontis, Bull. Jard. Bot. Brux. 25(3), suppl.: 312. 1955. — *A. bottae* Deflers, Voy. Yemen: 132. 1889. — *A. somalensis* Taubert in E. & P., Pflanzenfam. 3(3): 355. 1894; in Engler, Bot. Jahrb. 23: 193. 1896. — *A. gracilis* Lima, Broteria, Ser. Bot. 19: 127. 1921. — *A. repens* Tisserant, Bull. Mus. Hist. Nat. Paris, sér. 2, 5: 332. 1933; Cat. Fl. Oubangui-Chari: 92. 1950. — *A. aureus* Viguiet, Not. Syst. 14: 173. 1952. — *A. cyaneus* Viguiet, l. c.: 172 (p.p.; see also under *A. precatorius*). — *A. grandiflorus* Viguiet, l. c.: 172. — *A. madagascariensis* Viguiet var. *typicus*, l. c.: 174. — *A. madagascariensis* Viguiet var. *dunensis* Viguiet, l. c. 174. — *A. madagascariensis* Viguiet var. *littoralis* Viguiet, l. c.: 175. — *A. madagascariensis* Viguiet var. *parvifolius* Viguiet, l. c.: 174. — *A. sambiranensis* Viguiet, l. c.: 173. — *A. stictosperma* Berhaut, Mém. B. S. B. Fr., 1953—1954: 7. 1954; Fl. Sénégal: 30. 1954. — *A. suffruticosus* Boutique, Bull. Jard. Bot. Brux. 25(1): 127. 1955; in Fl. Congo Belge 6: 84. 1954 (nom. prov.). — *A. precatorius* L. var. *villosula* Miquel, Fl. Ind. Bat. 1: 159. 1855 (see note concerning *A. melanospermus* Hassk.). — *A. precatorius* L. var. *latifoliolatus* De Wildeman, Miss. Laur. 1: 118. 1905 (see note concerning *A. pulchellus* Wall. f. *latifoliolata* De Wild.). — *Hoepfneria africana* Vatke, Oesterr. Bot. Zeitschr. 29: 222. 1879.

A climber or a diffuse creeping fastigiate or straggling shrub or undershrub; young branches pubescent, finally glabrescent. Stipules mostly small, sometimes up to 10 mm long, oblong-lanceolate or linear, acute. Leaves (5)6—20-jugate; leaflets varying in shape and pubescence, ovate,

obovate, or oblong, 3—45(50) mm long, 1—15(20) mm wide, base cordate, rounded, or cuneate, often unequal-sided, top acute, rounded, obtuse, or truncate-emarginate, upper surface pubescent, glabrescent, or glabrous, lower surface densely to sparsely, mostly appressed-pubescent.

Inflorescence terminal, lateral, or axillary; flowers crowded or in groups. Bracts and bracteoles up to half as long as the calyx. Corolla 3—6 times as long as the calyx, pale purple to yellowish.

Pod oblong to linear, 2—7(9) cm long, 0.8—1.5 cm wide, flattened, broadly rounded or cuneate at the base, rounded at the apex, pubescent or glabrescent, sometimes warty, 4—12-seeded. Seeds oval-suborbicular, laterally compressed, 3—7 mm long, 2—5 mm broad, brown-black, mostly glossy.

Type: Peninsula Ind. orientalis, Wight 827 (BR: lectotype; G: iso-lectotype).

Distribution: Circumtropical.

Ecology: A climber on the edge of forest or in regrowth bush. A low to medium shrub in dry sunny places: open woodland, grass-, and shrub savannah.

Notes: As was pointed out in the introduction *A. fruticulosus* is a highly variable species. This variability may be connected with its very different habitats: rain forest to savannah country, or even semi-desert.

The type specimens on which the synonyms are based show certain differences between each other, and differ also from the type of *A. fruticulosus*. These differences, however, are always restricted to size or shape, indumentum, or number of leaflets, shape or place of the inflorescence, size or shape of the pods, or the habit of the whole plant.

Single or together, all these characters vary and all conceivable intermediates can be found as soon as a wide range of specimens from a sufficiently large area is examined.

To judge from the description *A. laevigatus* Meyer is conspecific with *A. fruticulosus* Wall. ex W. & A..

It is uncertain, whether the sheet present in the Kew Herbarium with two mounted specimens, both indicated as "Type Specimen" of *A. laevigatus*, represents the type material. On this sheet nothing can be found about the details of the collecting locality as Meyer indicated in his *Commentarium*. I traced the handwritings on this sheet, but only found that the labels "*Abrus laevigatus* E.M.a." and "*Abrus laevigatus* E.M.b." probably were written by the collector Drège. These two specimens and all specimens I saw from the area in which Drège collected the type specimens of *A. laevigatus* proved to be *A. fruticulosus* (or also *A. precatorius*).

I have not seen the type of *A. melanospermus* Hasskarl. To judge from Hasskarl's description, however, his plant is similar to a specimen collected in Java, presumably by Blume, and preserved in the Leiden Herbarium (Herb. Lugd. Bat. no. 908, 2—33). This is supported by the writings on the label: "*Abrus velutinus* Bl." in Blume's handwriting, and "*Abrus precatorius* var. *villosula* Miq. olim 1855" and "*Abrus melanospermus* Hassk. 1844", both in Miquel's handwriting. This specimen I designate as the type of *A. precatorius* L. var. *villosula* Miq..

Blume 831, collected in Java and now preserved in the Leiden Herbarium, was made the type of *A. acutifolius* Blume ex Miquel. This specimen is a form of *A. fruticulosus* with acute leaflets. This highly variable character is insufficient for the segregation.

Spruce 786, the type of *A. tenuiflorus* Spruce ex Benthham of which duplicates are preserved at Kew and at Genève, shows no difference from *A. fruticulosus*.

According to Thwaites's description of *A. pulchellus* Wall. ex Thw., this species is conspecific with *A. fruticulosus*. Moreover Dr. de Wit examined the type, Thwaites 1467, collected in Ceylon and present in the Herbaria at Genève and at Paris. He agreed with me, that Thwaites 1467 belongs in *A. fruticulosus*.

It is not clear what De Wildeman actually intended to publish, a distinct variety or a distinct form. He first published the "forma *latifoliolata*". Of this "forma" one of the specimens cited (Gillet 828 (BR)) belongs to a different genus (see Fl. Congo Belge 6: 85. 1954). Afterwards when De Wildeman referred to this "forma", he mostly cited it as a "var." and not as a "forma". The new combination "*A. precatorius* L. var. *latifoliolatus* De Wild.", published in 1905 (l.c.) is probably a lapsus calami.

A specimen present in the Leiden Herbarium (Herb. Lugd. Bat. no. 908. 2—40), collected in Java by Baeker, is labeled by the collector: "*Abrus pulchellus* Wall. var. *melanosperma*" and dated "Juni 1904". This specimen I designate as the type of *A. pulchellus* Wall. f. *melanosperma* Baeker, published in 1911 (l.c.).

Herb. H. F. Hance 13417, preserved in the Kew Herbarium and labeled "*Abrus cantoniensis*, Hance-Whampoa, Aug. 1869" is probably an isotype. The date and place of collecting, however, are not in accordance with the original publication and there is no indication about the actual collector.

Herb. H. F. Hance 15806, collected in China by Sampson & Hance f., type specimen of *A. mollis* Hance now preserved at Kew, is more hairy than other forms of *A. fruticulosus*, but this difference is not constant.

The shrubby East-African forms of *A. fruticulosus*, formerly named *A. schimperi* Hochst. ex Baker, based on Schimper 1552 collected in Ethiopia (see fig. 2: II) have mostly long, terminal inflorescences. The shrubby habit as well as the shape of the inflorescence are highly variable characters, and do not allow specific segregation.

I have not seen Botta 66 and 228, two plants collected in Yemen which became the type specimens of *A. bottae* Deflers. I was unable to trace these specimens. To judge from Deflers's description, however, Botta's specimens are conspecific with Schweinfurth (comm. Barbey) 1843, collected in Yemen and present in the Herbaria at Brussel and at Kew.

Hildebrandt 1391, collected in Somalia and made the type of *A. somalensis* Taubert, was probably lost at Berlin in 1943. Taubert's description in Bot. Jahrb. 23: 193. 1896, indicates nothing which might be considered to be a difference from *A. fruticulosus*. Vatke who listed and described several plants of the collection of Hildebrandt, said about no. 1391 that it was not unlike Hildebrandt 2797, the type of *Hoepfneria africana* Vatke

(Oesterr. Bot. Zeitschr. 29: 223. 1879). East-African specimens of *A. fruticulosus* very often have a silky indumentum on the young shoots and in my opinion *A. somalensis* Taub. is conspecific with *A. fruticulosus* Wall. ex W. & A..

Lima 257, the type of *A. gracilis* Lima, collected in Mozambique and now preserved in the Porto Herbarium, on examination proved to be conspecific with *A. fruticulosus*.

A. repens described by Tisserant (l.c.) is, according to the diagnosis, conspecific with *A. fruticulosus*. Dr. de Wit who examined in the Paris Herbarium the type specimens, Tisserant 738 and 2946, agreed with my conclusion. Tisserant's specimens represent a savannah form of *A. fruticulosus*, having a small shrubby habit and small leaflets.

The following taxa, which Viguier described in the genus *Abrus*, being *A. aureus*, *A. cyaneus* partly, *A. grandiflorus*, *A. madagascariensis* var. *typicus*, — var. *littoralis*, — var. *dunensis*, — var. *parvifolius*, and *A. sambiranensis*, appeared, judging from the descriptions, conspecific with *A. fruticulosus*. Moreover, Dr. de Wit examined in the Paris Herbarium all specimens on which Viguier based these taxa and agreed with me, that they all represent only very slightly different forms of *A. fruticulosus*.

Berhaut 1433, collected in Sénégal and now preserved in the Paris Herbarium, became the type of *A. stictosperma* Berhaut. The pod of this specimen is, according to the description, smaller than is generally found in African specimens of *A. fruticulosus*. I found, however, that this character is of small importance, because all conceivable intermediates in size of pod occur.

I examined the holotype (de Giorgi s.n.: BR) and most of the paratypes Boutique cited when he published the new name *A. suffruticosus*. All these specimens were collected in mostly dry localities and represented a shrubby form of *A. fruticulosus* with numerous small leaflets. There are, however, no characters to be found in these specimens, which singly or together do not gradually change into characters commonly seen in South- and East-African specimens of *A. fruticulosus*. (Some intermediate specimens are: Acocks 12352, Hornby 2825, Junod 75, Leendertz 795, Medley Wood 13008, Stolz 765). I therefore decided, that *A. suffruticosus* could not be separated from *A. fruticulosus* as a distinct taxon.

Hildebrandt 2797, the type of *Hoepfneria africana* Vatke now preserved at Kew, is a form of *A. fruticulosus*, formerly named *A. schimperi* Hochst. ex Baker.

4. *A. precatorius* L. — Fig. 5.

Linnaeus, Syst. 2: 472. 1767; DC., Prod. 2: 381. 1825; Desvaux, Ann. Sc. Nat. 11: 418. 1826; Wight & Walker-Arnott, Prod. 1: 236. 1834; Miquel, Fl. Ind. Bat. 1: 159. 1855; Bentham in Martius, Fl. Bras. 15(1): 215. 1859; Grisebach, Fl. Br. W. Ind. Isl.: 190. 1859; Harvey in Harvey & Sonder, Fl. Cap. 2: 262. 1862; Bentham, Fl. Austr. 2: 270. 1864; Baker in Oliver, Fl. Trop. Afr. 2: 175. 1871; in Hooker, Fl. Br. Ind. 2: 175. 1876; Blanco, Fl. Fil. 2: 361. 1879; Taubert in E. & P., Pflanzenfam. 3(3): 355. 1894; Engler, Pflanzenw. Ost Afr. C: 219. 1895; Koorders, Exk. Fl. Java 2: 397. 1912; Gagnepain in Lecointe, Fl. Gen. Indo-Chine 2: 357. 1916; Ridley,



Fig. 5. *A. precatorius* L. a: young branch ($\times \frac{1}{2}$); b: lower surface of leaflet ($\times 2$); c: inflorescence ($\times \frac{1}{2}$); d: parts of the corolla ($\times 2$); e: flower with removed corolla ($\times 3$); f: stamens ($\times 3$); g: anther ($\times 15$); k: ovary ($\times 10$); m: stigma ($\times 50$); n: bunch of pods ($\times \frac{1}{2}$); p: seed ($\times 2$).

Fl. Mal. Pen. 1: 558. 1922; Merrill, Enum. Phil. Flow. Pl. 2(5): 303. 1923; Fl. W. Trop. Afr. 1(2): 412. 1928; Baker f., Legum. Trop. Afr. 2: 351. 1929; Robijns, Fl. Spermat. Parc Nat. Albert 1: 338. 1948; Pellegrin, Legum. Gabon: 211. 1948; Tisserant, Cat. Fl. Oubangui-Chari: 91. 1950; Andrews, Flow. Pl. Sudan 2: 169. 1952; Schnell, Ic. Pl. Afr. 1: 9. 1953; Berhaut, Fl. Sénégal: 31. 1954; Boutique in Fl. Congo Belge 6: 85. 1954; Fl. W. Trop. Afr. 1(2): 574. 1958. — *A. precatorius* L. var. *novo-guineensis* Zipp. ex Miquel, l. c.: 159. — *A. maculatus* Noronha, Verh. Bat. Gen. 5(4): 69. 1790; nomen nudum. — *A. minor* Desvaux, l. c.: 418. — *A. pauciflorus* Desvaux, l. c.: 418. — *A. squamulosus* Meyer, Comm. 1(1): 126. 1836. — *A. abrus* (L.) Wright, Contrib. U. S. Nat. Herb. 9: 171. 1905. — *A. tungensis* Lima, Broteria, Ser. Bot. 19: 127. 1921. — *A. wittei* Baker f., Rev. Zool. & Bot. Afr. 21: 303. 1932. — *A. cyaneus* Viguier, Not. Syst. 14: 172. 1952 (p.p.; see also under *A. fruticulosus*). — *Glycine abrus* Linnaeus, Sp. Pl.: 753. 1753.

Winding climber, with glabrescent mostly green-yellowish young branches. Leaves 8–17-jugate, petiole 5–18 mm long; leaflets ovate, obovate, or oblong, 6–25 mm long, 3–9 mm wide, base rounded or subcordate, top obtuse or acuminate, upper surface glabrous or glabrescent, lower surface sparsely appressed-pubescent.

Inflorescence rigid, thick, strongly falcate; bracts and bracteoles 0.5–1 mm long. Flowers crowded, subsessile. Calyx \pm 3 mm long, pubescent. Corolla 3–5 times as long as the calyx, pale purple to yellowish.

Pods \pm rectangular, bulgy, 2–3.5(5) cm long, 1–1.5 cm wide, mostly densely warty, tomentose, 3–7-seeded; beak reflexed, hook-shaped. Seeds ovoid, 5–7 mm long, 4–5 mm broad, scarlet, with a black spot around the hilum, glossy.

Type: Ceylon, Herbarium Hermann, Flora Zeylanica 284 (BM). This specimen was kindly verified by Mr. A. W. Exell, who affirmed its identity as *A. precatorius* L..

Distribution: Circumtropical.

Ecology: Orchard savannah, shrub savannah, gallery forest, also in plantations or cultivated grounds.

Notes: Zippelius 89, the holotype of *A. precatorius* L. var. *novo-guineensis* Zipp. ex Miquel, collected in New Guinea and preserved in the Leiden Herbarium, has leaflets with a retuse or subemarginate top and long inflorescences. Accordingly, Miquel's description runs: "foliola retuso-subemarginata, mucronulata, racemi folio longiores". These characters, however, are not sufficient to accept it as a distinct variety.

In the Genève Herbarium Dr. de Wit found an *Abrus* specimen labeled: "*Abrus minor* Desv. Ann. Sc. Nat. p. 418 in Afric. Senegambie". A convolute on this sheet carried the note "*Abrus minor* fructus et semen", written in the same hand as on the label. The convolute is made of an old envelope, bearing the postmark "Angers 7 May" and the address "Monsieur Desvaux Nantes". The convolute contained a pod and a few seeds of *A. precatorius*. This specimen I designate as the type of *A. minor* Desv..

Desvaux's description of *A. pauciflorus* is confusing; and I have not found any type-material. The description of the seeds "seminibus sphaericis" and his note "Cette dernière espèce est double dans toutes ses pro-

portions de la précédente (= *A. precatorius*) et la tache noire de ses graines rouges est en croissant", fit *A. precatorius*, but his description of the pod "leguminibus (subbipollicaribus) compressis 8—11 locularis" perhaps may refer to *A. fruticulosus* Wall. ex W. & A.. Fortunately, Desvaux gave two references: "Rumph., Amb., 5, t. 32" which is undoubtedly a picture of *A. precatorius*, and: "Pluk., t. 414, f. 6". This last figure, however, is not a picture of a leguminous plant. The second reference presumably should be t. 214, f. 6, which is a drawing of a bunch of pods of *A. precatorius*.

I have not seen the type of *A. squamulosus* Meyer, a plant collected by Drège at Port Natal. Meyer's description of *A. squamulosus* fits *A. precatorius*. According to Meyer the difference from *A. precatorius* is restricted to the surface of the pod, which is "tenuissime squamulosotuberculatis" in the plant collected by Drège. This character, however, is so variable that it is not useful for specific segregation.

Lima 94 and 134, type specimens of *A. tungensis* Lima, collected in Mozambique and preserved in the Porto Herbarium, do not show any character which might be seen as a difference from *A. precatorius*.

The holotype of *A. wittei* Bak. f., de Witte 222a (BR), has rigid branches and inflorescences. This perhaps indicates some difference from the forms commonly found in *A. precatorius*, but it is not sufficient to segregate *A. wittei*. In my opinion, these rigidity of the branches and inflorescences of de Witte's specimen is quite accidental.

One of the type-sheets of *A. cyaneus* Viguiet carries a detached bunch of pods of *A. precatorius*. This explains why Viguiet described the pods and the seeds of *A. cyaneus* as follows: "Legumen breve 20 mm long., 10—12 mm lat., crassum, utrinque abrupte truncatum, villosum. Semina 2—4, ovoidea, haud compressa, 4—5 mm long., corallino-rubra, macula nigra ornata, carunculata".

The seeds of *A. precatorius* sometimes appear to be entirely black or white. This is not correlated with any morphological character and seems to be accidental.

Excluded species

Abrus arboreus Velloso, Fl. Flum.: 303; 7: t. 99 and *Abrus lusorius* Velloso l.c.: 302; 7: t. 97 have impari-pinnate leaves and flowers with ten stamens. According to Benthham (Fl. Bras. 15 (1). 1859), *A. arboreus* is conspecific with *Ormosia nitida* Vog. (l.c.: 315, 325) and *A. lusorius* is conspecific with *Rhynchosia phaseoloides* DC. (l.c.: 325).

Specimens examined

Specimens marked by * were examined by Dr. H. C. D. de Wit.

A. canescens Welw. ex Baker

Adams 4394: Ghana, Burufo (K); Bagshawe 731: Uganda, Entebbe (BM); Baldwin jr. 9405: Liberia, Gbau (K); Baldwin jr. 9773: Guinea, Macenta (K); Baldwin jr. 13869: Cameroun, N'Kongsamba (K); Barter s.n.: Nigeria, Jeba (K: W*); Bequaert 3950: B. Congo, Kengele (Beni) (BR); Bequaert 7166: B. Congo,

Leopoldville (BR); Bredo 2712: B. Congo, Kanismur (?) (BR); Brown 324: Uganda, Entebbe (K); Callens 1552: B. Congo, Fumu Dimi (BR); Casteels 26: B. Congo, betw. Gandola and Sali (BR); Chandler 1599: Uganda, Kamanda near Kampala (BR; K); Claessens 1709: B. Congo, Dendu (BR); Daniel 101: Liberia, Suacoco (BM; BR); Daramola & Adebunsi 38433: Nigeria, Bonu (WAG); De Graer 92: B. Congo, Doruma (BR); Deighton 2442: Sierra Leone, Njala (K); Deighton 4493: Sierra Leone, Musaia (K); Deru 448: Uganda, Kikube (?) (BR); De Schleppe 77: B. Congo, Kurukwata (BR); De Wilde 658: Ivory Coast, S.W. Oroumba-Boka (WAG); De Wilde 760: Ivory Coast, N. of Gr. Lahou (WAG); De Wit & Morton A 2887: Togo, Amedzofe (WAG); Donis 1770: B. Congo, Lemba (BR); Espirito Santo 1065: Port. Guinea, Bissau, Pussubé (COI; LISC); Espirito Santo 3116: Port. Guinea, betw. Bafata and Geba (COI; LISC); Espirito Santo s.n.: Port. Guinea, s.l. (LISC); Germain 2387: B. Congo, Gimbi (BR); Germain 7512: B. Congo, Lukavukavu (PRE); Gillardin 195: B. Congo, Lupatapata (Sunepi) (BR); Gossweiler 5842: Angola, Cazengo, Camundai (BM); Gossweiler 5842: Angola, Chilungo (K); Gossweiler s.n.: Angola, Cazengo, Camundai (LISC); (These last three sheets are most probably similar. The LISC specimen bears a label in Gossweiler's handwriting. The BM specimen is labeled in English, and the Kew specimen bears a printed label with the written number 5842).

Jones 2159 (FHI 4568): Nigeria, Udi (BM); Lebrun 4104: Uganda, Kasenyi (BR); Lebrun 6541: B. Congo, Bumbuli (PRE; U); Leonard 1781: B. Congo, Isangi (BR); Leontovitch 91: B. Congo, Gemena (BR); Le Testu 3145: Oubangui-Chari, Yalinga (BR); Meikle 1089: Nigeria, betw. Kontagora and Ibeto (BR; K); Michell 2822: B. Congo, Nyabitare (BR); Morton G.C. 9385: Togo, Amedzofe (K); Morton G.C. 9992: Ghana, Gonja (K); Morvan 1780: Guinea, Kindia (L); Mullenders 1894: B. Congo, betw. Kaniama and Haut Lomami (BR); Peter 38305: B. Congo, betw. Lübinga and Mivai (?) (K); Punch 32: Nigeria, Lagos (K); Purseglove P. 2422: Uganda, Kambuga, Kigezi (K); Quarre 2416: B. Congo, Mutuy (BR); Risopoulos 158: B. Congo, Porte Gandajika (BR); Robertson 82: Togo, Kpandu (BM); Ruxton 54: Gambia, Kuntaur (K); Schmitz 5263: B. Congo, Kinda (BR); Seret 162: B. Congo, Bima (BR); Small 371: Sierra Leone, Warantambe (K); Tessmann 2697: Cameroun, Komjola (?) (K); Thomas 2704: Sierra Leone, Jigaya (K); Thomas 3233: Sierra Leone, s.l. (K); Van de Brande 605: B. Congo, La Kulu (BR); Vanderijst 706: B. Congo, Myela (BR); Vanderijst 3533: B. Congo, Kitebe (BR); Vanderijst 11159: B. Congo, Kamtsha (BR); Vanderijst s.n.: B. Congo, Kinkonka (BR); Van Tillborg s.n.: French Congo, Boko (BR); Welwitsch 2250: Angola, Pungo Andongo (BM) (Holotype); Whyte s.n.: Kenya, Mumias (K); Wiuttund (?) 295: Uganda, Entebbe (K).

A. fruticosus Wall. ex W. & A.

Africa (including Madagascar)

Acocks 12352: Transvaal, Jacksonstun (PRE); Acocks 13366: Cape of Good Hope, Bizana (PRE); Adams 4222: Ghana, Gambaga (K); Angus 1574: N. Rhodesia, N. Kafue (PRE); Bagshawe 652: Uganda, Island of Burruma (BM); Baldwin 9775: Guinea, Macenta (K); Baldwin 10319: Liberia, W. Province, Tawata (K); Bally 8295: Tanganyika, Kissengi (K); Barbosa 180: Mozambique, betw. Marracuene and Bobole (COI; LISC); Barbosa 1339: Mozambique, Chimoio (LISC); Barbosa 1661: Mozambique, Durundi (BM; K; LISC); Barnard 268: Transvaal, Lijdenburg (PRE); Barter 1749: Nigeria, Nupe (K); Bates 604: Cameroun, Eholowa (BM; Z*); Bates 932: Cameroun, Yaoundé (BM); Baum 786: S.W. Africa, Onschingue (Kuito) (BM); Benedetto 124: Ethiopia, Dembidollo (FI); Berhaut 842: Sénégal, Mbao (?) (BR); Berhaut 1433: Sénégal, Gorom (P*) (type *A. stictosperma* Berh.); Berhaut 5600: Sénégal, Sangalkam (K); Bork (?) 474: Mozambique, Lourenço Marques (PRE); Burt 1431: Tanganyika, betw. Dodoma and Kondoia (K; PRE); Burt 2447: Tanganyika, Shinyanga Distr. (K); Burt 5115: Tanganyika, Shinyanga Distr. (BR); Burt-Davy 2613: S.W. Africa, Waterberg (PRE); Cabra-Michel 2: B. Congo, N. Manyanga (BR); Callens 2731: B. Congo, Pansi (BM); Callens 3122: B. Congo, Tumbi (BM); Chancellor 254: Uganda, W. Nile Distr. (BR; K); Chandler 1223: Uganda, Entebbe (BR; K); Chase 4182: S. Rhodesia, Commonage (Umtali) (BR; K; PRE); Chase 5178: S. Rhodesia, Commonage (Umtali) (K; PRE); Chevalier 3397: F. Sudan, Tabacco (BR; G*); Chevalier 10386: Tchad, betw. ft. Archambault and ft. Crampel (L; G*); Chiovenda 3204: Ethiopia, Amhara (FI); Chiovenda 3249: Ethiopia, Tigre (FI); Codd & de

Winter 4899: Transvaal, Kruger National Park, Nelspruit (PRE); Corbisier 595: B. Congo, Katanga (BR); Cruse 512: N. Rhodesia, Mufulira (BR; K); Dalziel 14: Nigeria, Lokoja (K); Davies 406: S. Rhodesia, Shangani (PRE); Davies 2031: S. Rhodesia, betw. Kariyangwe and Lusula (K); Davies s.n.: S. Rhodesia, Nbaza (?) Dam (K); Decary 1558: Madagascar, baie Radama (P*) (syntype *A. madagascariensis* Vig. var. *typicus*); Decary 1781: Madagascar, Ankaizimana (P*) (syntype *A. sambiranensis* Vig.); Decary 2034: Madagascar, Maromandia (Bejofo) (P*) (syntype *A. sambiranensis* Vig.); Decary 6335: Madagascar, Ambilo (P*) (syntype *A. madagascariensis* Vig. var. *littoralis* Vig.); De Giorgi 366: B. Congo, Tshinsangwe (BR); De Giorgi s.n.: B. Congo, Elisabethville (BR) (holotype *A. suffruticosus* Bout.); De Graer 745: B. Congo, Doruma (BR); Deighton 392: Sierra Leone, Kenema (BM); Deighton 1499: Sierra Leone, Njala (K); Deighton 5615: Sierra Leone, Sugar Loaf Mt. (K); Devred 720: B. Congo, Mvuazi (BR); De Witte 100: B. Congo, Kando (BR); Donis 1774: B. Congo, Luki (BR); Drummond 5570: S. Rhodesia, S.W. Mateke Hills (PRE); Dümmer 1099: Uganda, s.l. (BM); Dümmer 5036: Kenya, Kibwezi (K); Dupuis s.n.: B. Congo, Bingila (BR); Eggeling 6086: Tanganyika, betw. Itigi and Chunya (K); Espirito Santo 676: Port. Guinea, Cacine (COI); Espirito Santo 927: Port. Guinea, Bissau, Pussube (COI; LISC); Espirito Santo 1583: Port. Guinea, bet. Bissau and Peluba (COI; K; LISC); Espirito Santo 3406: Port. Guinea, Ritche, Cambore (COI; LISC); Espirito Santo 3546: Port. Guinea, betw. Nova Lamego and Canjufa (COI; LISC); Espirito Santo 3596: Port. Guinea, betw. Sonaco and Bafata (COI; LISC); Espirito Santo 3647: Port. Guinea, Farim (COI); Espirito Santo s.n.: Port. Guinea, Bor (COI); Errard 1832: B. Congo, Popolo (BR); Exell, Mendonça & Wild 1396: N. Rhodesia, Mufulira (BM); Eyles (?) 5079: S. Rhodesia, Gatooma (K); Fanshawe 1015: N. Rhodesia, Ndola (BR; K); Fanshawe 2219: N. Rhodesia, Kitwe (BR; K); Flanagan 1064: Cape of Good Hope, Kei Mouth (PRE); Frahm-Leliveld 61: Ivory Coast, Adiopodoumé (WAG); Galpin 781: Transvaal, Barberton (PRE); Gathy 431: B. Congo, N.W. Elisabethville (K; PRE); Gathy 591: B. Congo, N.W. Elisabethville (K); Gathy 1186: B. Congo, N.W. Elisabethville (PRE); Germain 2212: B. Congo, Kwango (BR); Gillet 1094: B. Congo, Kisantu (BR); Gillet 2113: B. Congo, Kimuenza (BR); Gossweiler 2830: Angola, Menongue (BM; LISC); Gossweiler 5870: Angola, N'Dalatanda (BM; BR); Gossweiler s.n.: Angola, Kacunda (?) (BR); Greenway 7398: Tanganyika, Shinyanga Hill (K; PRE); Hazel 633: Uganda, Ierego (BR; K); Hepburn 89: Nigeria, Mada Hills (K); Hildebrandt 2797: Kenya, Kitui (K) (type *Poepfneria africana* Vatke); Holst 2825: Tanganyika, Tanga (K; M*); Homblé 247: B. Congo, Elisabethville (BR); Homblé 1302: B. Congo, Vallée Kapiri (BR); Hornby 2825: Swaziland, Lebombo Mts. (PRE); Humbert 6810: Madagascar, Mandrare (P*) (syntype *A. aureus* Vig.); Huntley 760: Natal, Port Edward (PRE); Jordan 381: Sierra Leone, Rokupr (K); Junod 75: Transvaal, Marovuni (PRE); Junod 196: Mozambique, Delagoa Bay (BR; G*); Junod 4347: Transvaal, Zoutpansberg (PRE); Kassner 668: Kenya, Kin (?) (K); Kassner 2596: B. Congo, Kundelungu Mt. (BM); King 25 B: Sierra Leone, s.l. (K); Koritschöner 1756: Tanganyika, Samuye (?) (K); Laurent, E. & M. s.n.: B. Congo, Imese (BR); Laurent, E. & M. s.n.: B. Congo, Irebu (BR); Leendertz 795: Transvaal, Rooiplaat (L); Leeuwenberg 2137: Ivory Coast, Tiassalé (WAG); Le Testu 3988: Oubangui-Chari, Yalinga (K; P*); Liebenberg 255: Uganda, Kitgum (PRE); Liebenberg 2408: Transvaal, Barberton (PRE); Lima 257: Mozambique, Palma (PO) (holotype *A. gracilis* Lima); Losty & Goddijn 1108: Transvaal, Hartbeestpoort (L); Louis 2046: B. Congo, Kala (FI); Louis 7190: B. Congo, Yangambi (BR); Louis 12861: B. Congo, Yangambi, Ile Tofende (BM; K); Lovemore 526: S. Rhodesia, Sebungwe, Chiconba R. (PRE); Martin 164: N. Rhodesia, Baikiaea for. reg., Kalahari sand (BM); Medley Wood 7920: Natal, Groenberg (PRE); Medley Wood 13008: Natal, Inchanga (L); Michel 3287: B. Congo, Kihinga (BR); Mogg s.n.: Transvaal, Rustenburg (PRE); Morton 6052: Ghana, Volta R. (K); Nalde 131: Angola, Quela (BM); Napier 976: Kenya, Voi Distr. (K); Nornby 3146: S. Rhodesia, Serui Drift (PRE); Onochie & de Wit 679: Nigeria, Gambari F. Res. (WAG); Pappi 7219: Ethiopia, Bogos, Cheren (FI; Z*); Pedro & Pedrogad 937: Mozambique, betw. Boane and Goba (PRE); Pegler 669: Cape of Good Hope, Kentani (PRE); Pentz 220: Natal, Blauwkrans R. (PRE); Perrier 529 bis: Madagascar, Ambongo (P*) (syntype *A. madagascariensis* Vig. var. *typicus*); Perrier 1038: Madagascar, Belambo (P*) (type *A. cyanus* Vig.); Perrier 4135: Madagascar, Sambirano (P*) (syntype *A. sambiranensis* Vig.); Perrier 4143: Madagascar, Tsaratanana (P*) (syntype *A. grandiflorus* Vig.); Perrier 4152: Madagascar, Loky (P*) (syntype *A. madagascariensis* Vig. var. *duncensis* Vig.); Perrier 12357: Madagascar,

Analamazaotra (P*) (syntype *A. aureus* Vig.); Perrier 12376: Madagascar, Mania-Ivato (P*) (type *A. madagascariensis* Vig. var. *parvifolius* Vig.; Perrier 12387: Madagascar, Ambatoforigina (P*) (syntype *A. aureus* Vig.); Perrier 15552: Madagascar, Tsaratanana (P*) (syntype *A. grandiflorus* Vig.); Perrier 15785: Madagascar, Majunga (P*) (syntype *A. madagascariensis* Vig. var. *dunensis* Vig.; Perrier 15997: Madagascar, Ambilo (P*) (syntype *A. madagascariensis* Vig. var. *littoralis* Vig.); Perrier 16012: Madagascar, Analamazaotra (P*) (syntype *A. aureus* Vig.); Perrier 16765: Madagascar, Betsiboka (P*) (syntype *A. aureus* Vig.); Perrier 16933: Madagascar, Marolambo (P*) (syntype *A. aureus* Vig.); Perrottet 212: Sénégal, s. l. (BM); Peter K 81: Tanganyika, near Kissangara (N. Pare) (K); Peter 34771: Tanganyika, Malongwe-Triva (K); Peter 35245: Tanganyika, Tabora (K); Peter 38916: Tanganyika, betw. Ujiji and Kigoma (K); Pierce 18: Swaziland s.l. (PRE); Pollen & Verdam s.n.: Madagascar, s.l. (L); Prittwitz 136: Tanganyika, s.l. (U); Punch 47: Nigeria, Lagos (K); Pynaert 40: B. Congo, Bumba (BR); Quarré 1044: B. Congo, Ferme Prince Leopold (BR); Quarré 1131: B. Congo, Munama (BR; PRE); Quarré 1150: B. Congo, Munama (BR); Reeh 1: Transvaal, Letaba (PRE); Repton 1518: Pretoria, Wonderboom Res. (PRE); Richards 4642: N. Rhodesia, Nimkola (K); Richards 7930: Tanganyika, betw. Igawa and Mbeya (K); Ringoet 11: B. Congo, Tshinsenda (BR); Robijns 1506: B. Congo, Bukama (BR); Robijns 1563: B. Congo, Munama (BR); Robijns 1883: B. Congo, Kasenga (BR); Rogers 26290: B. Congo, Elisabethville (K); Rousseau s.n.: Ethiopia, Mt. Smith (L); Rudatis 1833: Natal, Dumisa (L; PRE; W*; Z*); Scheffler 138: Kenya, Kibwezi (K; P*; W*); Schimper 1552: Ethiopia, Djeladjeranne (BR; FI; G*; K; L; M*; P*; W*) (type *A. schimperi* Hochst. ex Bak.); Schimper 165 (123): Ethiopia, Djeladjeranne (FI); Schlechter 4524: Transvaal, Elim (BM; G*; Z*); Schlieben 6160: Tanganyika, Lindi (BM; BR; G*; M*; Z*); Schmitz 2781: B. Congo, Etoile (BR); Schweinfurth 2137: Sudan, Lande der Bongo (K; M*; W*); Schweinfurth 2166: Sudan, Lande der Bongo (FI; P*); Schweinfurth 2345: Sudan, Seriba Ghattas (K); Smith 6845: Transvaal, Magaliesberg (PRE); Stolz 465: Nyasaland, Kyimbila (K); Stolz 765: Nyasaland, Kyimbila (L; M*; U; W*; WAG); Tanner 1361: Tanganyika, Mwanza (K); Tessmann 576: Spanish Guinea, Bebuí (?) (K); Thielen 22123: B. Congo, Bas Katanga (BR); Thode A 414: Transvaal, Pretoria (PRE); Thomas 3767: Sierra Leone, Bumbuna (BM); Thomas 4466: Sierra Leone, Mamaka (BR); Tisserant 738: Oubangui, les Moroubas (P*) (syntype *A. repens* Tiss.); Tisserant 2946: Oubangui, Bozoum (P*) (syntype *A. repens* Tiss.); Ujor 29395: Nigeria, Gambari F. Res. (K); Van de Schijff 2594: Transvaal, Kruger National Park (PRE); Van Meel 5322: B. Congo, Kanonga (BR); Van Meel 5382: B. Congo, Kanonga (BR); Van Someren 168: Kenya, Garabani Hill (K); Vaughan 2377: Tanganyika, Pugu Hills (BM); Verdick 474: B. Congo, Lukafu (BR); Verheyen 3451: B. Congo, Mweleshi (BR); White 2105: N. Rhodesia, Mankoya, Luampa Mission (BR; K); White 2539: Nyasaland, Rumpi, Njakwa (BR; K).

America

Focke 881: Dutch Guyana, Onoribo (U); Kuhlmann 3230: Brazil, Rio Branco (U); Spruce 786: Brazil, Santarem (K; G*) (type *A. tenuiflorus* Spruce ex Benth.); Ule 6038: Brazil, Rio Negro (L).

Asia

Andamans s.n.: India, Hobdaypur (L); Backer 7864: Java, Djatirato (L); Backer s.n.: Java, Batavia (L) (type *A. pulchellus* Wall. ex Thw.f. *melanosperma* Backer); Basker s.n.: Java, Batavia, Depok (WAG); Bakhuizen van den Brink jr. 1041: Java, Tjiboerli (L; U); Bakhuizen van den Brink jr. 1487: Java, Tjikidang (L); Blume 831: Java, s.l. (L) (type *A. acutifolius* Blume ex Miq.); Binnemeyer 11088: Celebes, Lombasang (L); Binnemeyer 11225: Celebes, Lombasang (L); Binnemeyer 11294: Celebes, Lombasang (L); Carr 12363: New Guinea, Rouna Falls (BM); Carr 12364: New Guinea, Rouna Falls (BM); Fenix s.n.: Philippines, Bauang (BM; L); Gibbs 8: China, Hongkong, Tai Po (K); Hallier 4345: Philippines, Luzon (L); Helfer 85: India, Calcutta (BR; L); Hosseus 155: Siam, Kan-Phra-Dang (BM); Lei 44: China, Pak Shik Ling (K); Levine 1849: China, Canton (K); Merrill 3265: Philippines, Mt. Mariveles (L; G*); Monod de Froideville 72: Celebes, Moena (L); Raap 528: Java, Bantardjati (L); Sampson 1553: China, Canton (K); Sampson s.n.: China, Canton (K); Sampson & Hance f. s.n. (Herb. Hance 15806): China, Shek-mun

(Canton) (K; W*) (type *A. mollis* Hance); Schiffner 2104: Java, Mt. Salak (L); Schweinfurth (comm. Barbey) 528: Yemen, Gebel Mehegjarja (K); Schweinfurth (comm. Barbey) 1843: Yemen, Agara (BR; K); Strachey & Winterbottom 2: India, Kota (BR); Thesinger s.n.: Arabia, Asir, Harub (BM); Thomson s.n.: India, Maisor & Carnatic (L; W*); Thwaites 1467: Ceylon, Belanger (G*; P*) (type *A. pulchellus* Wall. ex Thw.); Tsang 21739: China, Tung Koo Shan (K); Tsiang Ying 963: China, Kwaungtung, Kochow (K); Vesey-Fitzgerald 16290/10: Arabia, Jabal Faifa (BM); Wight 731: India, s.l. (L; W*); Wight 827: India, s.l. (lectotype (BR) & isotype (G*) *A. fruticosus* Wall. ex W. & A.); Zollinger 506: Java, s.l. (BM); Zollinger 2758: Java, s.l. (BM; G*).

A. precatorius L. (African specimens only)

Baldrati 4280: Ethiopia, s.l. (FI); Baldrati 4350: Ethiopia, s.l. (FI); Baldrati 4361: Ethiopia, s.l. (FI); Baldrati 4363: Ethiopia, s.l. (FI); Barbosa 1216: Mozambique, Manica (LISC); Barbosa 1936: Mozambique, Montepuez (LISC); Barbosa 2618: Mozambique, betw. Memba and Cavá (LISC); Beccari 183: Ethiopia, Keren (FI); Bequaert 726: B. Congo, Malela (BR); Berhaut 568: Sénégal, Cambérène (BR); Chandler 1456: Uganda, Kajansi Forest, Entebbe Rd. (BR); Chevalier 45093: Cape Verde Islands, Fogo (COI); Croockewit 608: B. Congo, Usumbara (WAG); De Carvalho s.n.: Mozambique, Mussoville (COI); De Graer 945: B. Congo, Doruma (BR); Devred 3254: B. Congo, Luki (BR); Dewevre 585: B. Congo, Coquilhatville (BR); De Wilde 494: Ivory Coast, Bingerville (WAG); De Wilde 808: Ivory Coast, betw. Abidjan and Gr. Bassam (WAG); De Witte 222a: B. Congo, Kiambi (BR) (holotype A. wittei Bak. f.); Espirito Santo 1485: Port. Guinea, betw. Bissau and Antula (COI; LISC); Espirito Santo 3705: Port. Guinea, bet. Susana and Catão (COI; LISC); Evrard 317: B. Congo, Bodangabo (BR); Exell & Mendonça 2415: Angola, Pôsto da Tampa (LISC); Faulkner 236: Mozambique, betw. Lugela and Moenba (BR); Flamigni 10400: B. Congo, Pandji (BR); Garcia 746: Mozambique, Chimoio (LISC); Germain 5832: B. Congo, Plaine Ruzizi (BR); Hagerup 766: Nigeria, Jebba (BR); Jackson 1383: Nyasaland, Nankumba (BR); Junod 163: Mozambique, Delagoa Bay (BR; Z*); Lanjouw 968: Transvaal, Barberton (U); Laurent 1135: B. Congo, Eala (BR); Laurent, E. & M. s.n.: B. Congo, Bumba (BR); Lebrun 4102: Uganda, Kasenyi (BR); Lima 94: Mozambique, Palma (PO) (syntype *A. tungensis* Lima); Lima 134: Mozambique, Palma (PO) (syntype *A. tungensis* Lima); Louis 9534: B. Congo, Isl. "Esali" (Yangambi) (BR); Mendonça 3374: Mozambique, betw. Inharrime and Chidenguel (LISC); Michel & Reed 809: B. Congo, Gisuru (BR); Mullenders 1644: B. Congo, betw. Kaniama and Haut Lomami (BR); Paoli 655: Somalia, El Magu (FI); Pappi 4491: Ethiopia, Harara near Ghinda (FI); Pappi 5443: Ethiopia, Lungo (FI); Pedro & Pedrogad 1260: Mozambique, betw. Guja and Canicado (COI); Peter 69 (?): Tanganyika, Kilimandscharo (BR); Peter 229: Tanganyika, betw. Mapinga and Kondütschi (BR); Robijns 147: B. Congo, Kisantu (BR); Schlieben 2685: Tanganyika, Mafia Isl. (BR; M*; P*); Schlieben 4019: Tanganyika, Morogoro (BR; Z*); Schlieben 6177: Tanganyika, Lindi (BR; G*; M*; P*; Z*); Schmitz I, 911: B. Congo: Vallée Lofoi (BR); Schweinfurth & Riva 2162 (950): Ethiopia, Ghinda (FI); Thomas 5203: Sierra Leone, Zoni Kana (BR); Torre 2508: Mozambique, Majacaze (LISC); Torre 3607: Mozambique, Zambesia, betw. Mocuba and Nicuadala (LISC); Vatova 1381: Somalia, Margherita (FI); Wallace 711: Tanganyika, Mafia Isl. (BR); Warnecke 202: Togo, near Lomé (BR; G*; L; M*; P*); Welwitsch 2248: Angola s.l. (LISC).

A REVIEW OF THE GENUS RHIZOPHORA

with special reference to the Pacific species

by

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Introduction

The species of the Atlantic *Rhizophora* have formerly been considered as belonging to one species, *R. mangle* L. In 1818 G. F. W. Meyer (11) described a second species, *R. racemosa*, from British Guiana. On working up the *Rhizophoras* of British Guiana Leechman (10) added a third species, *R. harrisonii* in 1908, and distinguished all these three species. Through the works of Salvoza (13), Savory (14), Keay (9), Stearn (15), and Jonker (8), it has become clear that these three species occur on the West African and East American shores as well as in some Caribbean islands.

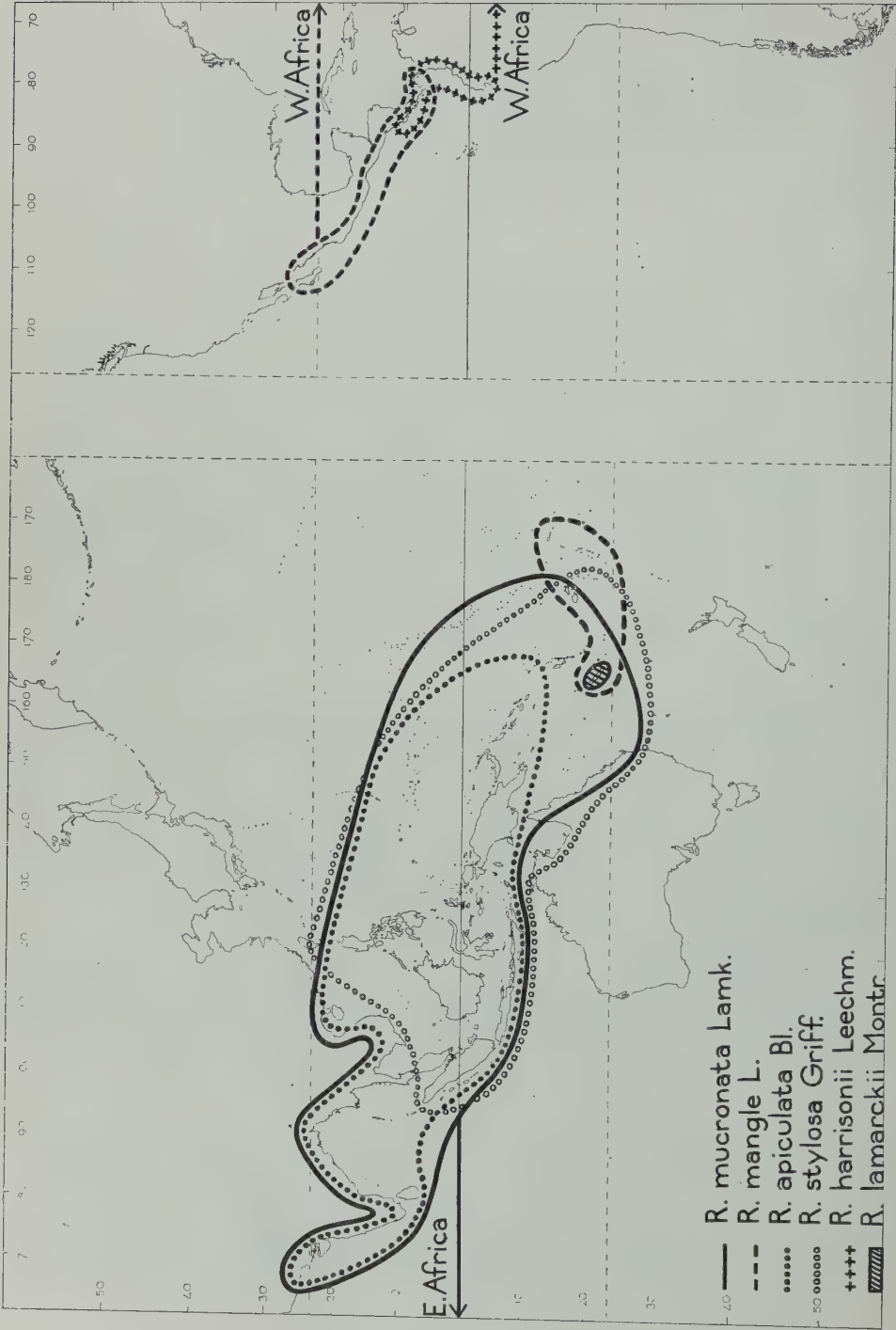
In the Old World, from the coast of East Africa to Malaysia, there are also three (other) distinct species as distinguished by many authors and by myself (7).

The occurrence of *Rhizophora* in the Pacific is remarkable as none of the species occurs native in the central part east of Micronesia and the Tonga group; there is a record by Forster (1) from the Society Islands, but this looks suspect as it has not been corroborated by any later collection. Eastward of the Tonga group *Rhizophora* appears first on the Galápagos Islands and on the Pacific coast of America from Lower California to Ecuador.

The Indian Ocean and Atlantic Ocean species find their meeting place in the Pacific Ocean but hitherto there has been no unanimity of opinion about the species involved. Onwards of Forster (1), such later authors as Hemsley (6) and also Guppy (4) maintained the occurrence of *R. mangle* in the Pacific. Unfortunately they did not make a thorough taxonomic investigation of the matter.

In his revision of the genus Salvoza (13) denied the occurrence of any Caribbean species in the Pacific, even on the west coast of America. He recorded various new species for the Pacific area, viz *R. brevistyla*, confined to the west coast of America, and *R. samoensis*, from the Pacific coast of America and from the West Pacific. Further he recognized another already described species, *R. lamarckii*, confined to New Caledonia.

I have come to the conclusion that the Pacific contains all species



of *Rhizophora* (except *R. racemosa*), viz *R. mangle* (incl. *R. samoensis*) on the American coast, the Galápagos Islands, the Fiji-Tonga group, and New Caledonia, *R. harrisonii* (incl. *R. brevistyla*) on the American coast, a local-endemic species *R. lamarckii* in New Caledonia, and *R. apiculata*, *R. mucronata*, and *R. stylosa* in the West Pacific.

On the accompanying map the distribution of the Atlantic *R. racemosa* has been omitted and it has not been attempted to draw the detailed distribution of *R. mangle* and *R. harrisonii* in the Caribbean because the map is primarily intended to show the generic distribution in the Pacific.

Plant-geographically it is most remarkable that a very large part of the Pacific seems to be devoid of any mangrove, the gap between the nearest stations of *R. mangle* being about 60 longitudinal degrees, if discarding the doubtful Forster record of the Society Islands from the discussion.

It is quite possible that Guppy (4) is right in part that the dispersal in living condition of the seedlings (hypocotyls) is impossible over very large distances, as he rightly assumes that the climate is no barrier for their distribution. This is also shown by the successful planting experiments of many mangrove genera in Hawaii where they thrive and multiply after their introduction in the twenties.

But it could be understood that seedlings cover smaller distances with success, provided there is a favourable sea current or wind causing a surface current for transport, and provided that they would arrive at suitable muddy coastal flats without injury in passing a heavy surf over sandy beaches, because surf on coral fringes or on rocky coasts is of course detrimental to the delicate plumule. In this way they could hop from one island to another.

It is probably the very scarcity of these ecologically suitable coastal conditions to receive seedlings which prohibits a wide dispersal and profusion of localities in the Pacific.

The identification of the Pacific *Rhizophoras* leads to a discussion on the history of the distribution of the genus. Obviously it was already present with a large distribution before the closing of the isthmus of Panama when the Atlantic and Pacific Oceans stood in open connection and the Americas were separated by open ocean. Two species are still present on both sides of the isthmus, viz *R. mangle* and *R. harrisonii*. And it is quite possible that future field work will also show the presence of *R. racemosa* on the American west coast.

As the coastal *Rhizophoraceae* are most abundantly developed in the Indian Ocean and West Pacific and five out of seven species are found in the West Pacific, it is most probable that the genus had its birthplace and ancient distribution in that part of the world and later spread through the Pacific to the Americas, passing between them, entered the Caribbean, and spread from there to the west coast of Africa. This explanation goes parallel with the explanation of distribution of several sea-grasses given by Den Hartog (5).

There occurs a slight indication of racial differentiation in two species.

The Pacific specimens reckoned to *R. samoensis* have generally a shorter style and ovary apex than those (cf. *R. mangle*) in the Caribbean.

but there is a range of intermediates defeating the use of this character even for varietal distinction.

The Pacific specimens of *R. brevistyla* have usually shorter pedicels than the Caribbean *R. harrisonii*.

R. lamarckii is the least understood species, but the collections of it are very homogeneous. In its hairy petals it approaches *R. mucronata*, but they are flat and thin as in *R. apiculata*. It has mostly two flowers per inflorescence and sometimes four as found in *R. mucronata* but never in *R. apiculata*. There is little possibility that it is of hybrid origin as it produces ripe fruit. Besides no hybrids are known in the genus, save a suggestion by Guppy (4) who believed to have found some specimens in Fiji with aborted pistils which he believed to be due to hybridisation.

Sterile specimens of *Rhizophora* and *Bruguiera* sometimes have been confused in the herbarium. However, the number and arrangement of vascular bundles in the leaf-scars provide a constant and reliable character to separate them. In *Rhizophora* each scar bears several vascular bundles arranged in two rows while in *Bruguiera* each scar has only one series of three bundles.

At the instigation of Dr van Steenis and with his indispensable help, I have undertaken to review the genus *Rhizophora* and to present a preliminary revision of the species concerned.

I have prepared a key to all seven species of *Rhizophora*, including also *R. racemosa* which may appear to occur on the west coast of America. All the specimens which I have examined have been enumerated in the "Identification Lists of Malaysian Specimens, 4. Rhizophoraceae, Sept. 1959".

I had the privilege of studying the material from the Herbaria at Leyden, Bogor, Kew, the Arnold Arboretum, the British Museum, Cambridge (England), Paris, and the Smithsonian Institution at Washington, D. C.

Key to the species

- 1.a. Leaf-tips acute or even mucronate, not recurved, never rolled up. Mature fruit straight 2
- b. Leaf-tips recurved or rolled up and appearing very blunt or sometimes slightly truncate in the herbarium. Mature fruit sometimes slightly curved 5
- 2.a. Petals hairy. Inflorescences mostly in the axils of leaves. Flowers usually short-pedicelled 3
- b. Petals glabrous. Inflorescences always in the axils of leaf-scars. Flowers sessile. Bracteole-cup at the base of the flower with irregularly lacerate or dentate margin 4. *R. apiculata* Bl.
- 3.a. Petals with incurved margins, densely long-hairy on the margins, partly clasping the epipetalous stamens. Inflorescences 2—8(—16)-flowered. Bracteole-cup at the base of the flower distinctly 2-lipped. Stamens mostly 8 4
- b. Petals flat, sometimes slightly concave, sparsely short-hairy on the margins, sometimes also on the inside, usually covering the epipetalous stamens only on the back. Inflorescences 2(—4)-flowered. Bracteole-cup at the base of the flower with irregularly lacerate or dentate margin, not 2-lipped. Stamens usually 12—15. 3. *R. lamarckii* Montr.
- 4.a. Free part of the ovary high conical, in anthesis already emerging far beyond the disk; style obscure or very short up to 1½ mm. Stamens usually sessile. 1. *R. mucronata* Lamk.
- b. Free part of the ovary depressed-conical, in anthesis enclosed by the disk;

- 5.a. Inflorescences once or rarely twice branched, usually 2-flowered, occasionally 3- or 4-flowered. Flower bud usually slightly 4-angular in the herbarium, the tip slightly curved, one of the calyx lobes slightly longer than the others and cucullate. style filiform, 4—6 mm. Stamens distinctly short-filamentous. 2. *R. stylosa* Griff.
- b. Inflorescences much branched, many-flowered. Flower bud straight, smooth, calyx lobes equal in length. 6
- 6.a. Inflorescences loose. Bracteole-cup at the base of the flower distinctly 2-lipped. Flower buds acute to acuminate. (Pedicels (3—)6—10 mm long) 6. *R. harrisonii* Leeche.
- b. Inflorescences rather contracted. Bracteole-cup at the base of the flower irregularly lacerate or dentate. Flower bud obtuse. (Pedicels 3—4 mm long). 7. *R. racemosa* G. F. W. Mey.

1. *Rhizophora mucronata* Lamk. For synonymy, references, and description see Fl. Mal. I, 5, 1958, 453.

This is the most widely distributed species of *Rhizophora* in the Old World tropics, occurring from the coast of East Africa throughout Malaysia and southeastern Asia to the Pacific islands as far as the Tonga group.

One specimen, collected by G. C. Moor, 132 (US) at Guam, has inflorescences borne in the axils of leaf-scars, each bearing 4 pedicelled flowers. The bracteole-cup at the base of the flower has an irregularly lacerate or dentate margin. The petals are slightly involute and sparsely hairy on the margins. It is similar to *R. mucronata* except for the position of the inflorescences and the shape of the bracteole-cups; these two characters resemble those of *R. lamarckii* and *R. apiculata*. It might be of hybrid origin.

2. *Rhizophora stylosa* Griff. For synonymy, references, and description see Fl. Mal. I, 5, 1958, 456.

This species is distributed from Formosa throughout Malaysia (no record for Borneo) to Melanesia (New Britain, Solomon Isl. and New Caledonia), northern Australia, Fiji and Micronesia (Guam and Marshall Islands).

It is quite closely related to *R. mucronata*, and Schimper had reduced it as a variety of the latter. In addition to the characters indicated in the key *R. stylosa* can easily be separated in the herbarium from *R. mucronata* by the rather smaller leaves and flowers, more-flowered inflorescences, and the petals with longer hairs along the margins. Furthermore they also differ in ecology: *R. stylosa* is exclusively found along sandy shores and on sand-covered coral terraces facing the open sea, while *R. mucronata* is generally gregarious near and on the banks of tidal creeks and on deep soft mud of estuaries.

3. *Rhizophora lamarckii* Montrouzier, Mém. Acad. Sc. Lyon 10, 1860, 201; Salvoza, Nat. Appl. Sc. Bull. Un. Philip. 5, 1936, 229, t. 9. — *R. pachypoda* Baillon, Adansonia 11, 1875, 309. — *R. conjugata* var. *lamarckii* Guillaumin, Not. Syst. 3, 1914, 56.

This species is known only from New Caledonia.

Montrouzier might not have kept a type specimen of it. I have had the New Caledonian material of *Rhizophora* on loan from the Muséum National d'Histoire Naturelle, Paris, but there is no type of this species.

Montrouzier described the calyx lobes and petals as varying from 4—5. I have examined this character in all specimens available and always found 4, the usual number in the genus.

Baillon might have overlooked Montrouzier's binomial in describing a new species, *R. pachypoda*, based on Balansa 2341 collected at Canala, New Caledonia.

Guillaumin, in 1914, reduced *R. lamarckii* as a variety of *R. conjugata* (= *R. apiculata*), from which it would be distinct by leaves which are broadly ovate, pointed at the apex, and abruptly attenuate at the base.

Salvoza, in revising the genus *Rhizophora* in 1936, retained Montrouzier's species.

The species is most allied to *R. apiculata*, especially by the usually 2-flowered, short, robust inflorescences, cupular and dentate bracteole-cup. It differs from the latter by the petals which are hairy on the margins and sometimes also on the inside, the usually short-pedicelled flowers, and (8—)12—15 stamens of which, in case there are 15, sometimes 3 of them are very small or staminode-like. The leaves are elliptic to broadly elliptic and in the herbarium usually reddish- to black-brown while those in *R. apiculata* are generally elliptic-oblong to sub lanceolate and usually light brown to brown. This species seems more variable than *R. apiculata*, e. g. the inflorescences consist usually of 2, rarely of 4, flowers (not always 2 as in *R. apiculata*), the inflorescences are borne in the axils of the leaf-scars or in those of the leaves (not always in the axils of the leaf-scars), the petals are membranous, flat, sometimes slightly thicker and their margins are involute (not always membranous and more or less flat), and stamens vary in number between (8—)12—15 (not mostly 12).

4. *Rhizophora apiculata* Blume. For synonymy, references, and description see Fl. Mal. I, 5, 1958, 452.

This species is commonly found in most mangrove swamps in tropical Asia (India, Ceylon, Burma, Siam, Indochina and China) throughout Malaysia to Micronesia (Marianes and Caroline Islands) and Melanesia (New Britain, Solomon Islands and New Hebrides).

5. *Rhizophora mangle* Linné. For synonymy and references see Keay, Kew Bull. 1953, 123.

This species is widely distributed along the tropical coasts in West Africa, the Caribbean Islands, America and a few Pacific islands (New Caledonia, Fiji, Tonga, and Galápagos).

In tropical America, *R. mangle* occurs on both sides of the coastal regions. In 1936, Salvoza (13, p. 206) stated that "mangrove species on one side of the American continent differ from those on the other side. The Isthmus of Panama acts as a geographical barrier to natural dissemination and interbreeding among the different species." He separated the west coast population of *R. mangle* L. from that of the east coast and placed the former together with those of the Pacific islands as a distinct species, *R. samoensis* (Hoehr.) Salvoza (13, p. 220).

Guppy (4, p. 445) made in a table a comparison of the species of *Rhizophora* in Fiji and Ecuador; as already rightly pointed out by Salvoza,

Guppy's "*Rhizophora mangle*" of Fiji and his "*mangle chico*" of Ecuador are conspecific and with the exception of minor vegetative differences must be referred to *R. samoensis*. In revising the *Rhizophoraceae* for the Flora of Panama, Gregory (2) accepted Salvoza's interpretation. There seems to be no doubt on the conspecificity of this *Rhizophora* from the Pacific islands with the population of the American Pacific coast. It would be much desirable to make a field study of *Rhizophora* on both sides of American coastal regions.

The specimens of *R. mangle* and *R. samoensis* have been on loan from the National Herbarium, U. S. A., and most of them have been cited by Salvoza in his revision. All these specimens have been sorted into three geographical groups: 1) Pacific islands, 2) American Pacific coast, and 3) American Atlantic coast. From the available herbarium specimens these three groups appear to be conspecific and certain minor quantitative differences vary only in degree. According to Salvoza one of the chief differences between *R. mangle* and *R. samoensis* would be the relative length of style which is 5 to 6 mm in the former and much shorter in the latter. However, he cited the style of *R. samoensis* as $1\frac{1}{2}$ — $2\frac{1}{2}$ mm long in his description and 2 to 3 mm in his key. The ovary is half-inferior and its free part is conical, gradually narrowing into the style. Because of lack of a clear distinction between ovary and style, I have taken the measurements of the length of pistil from the top of the disk to the tip of the stigma as Gregory did (2). The measurements then range 4—5 mm, $4\frac{1}{2}$ —6 mm, and 5—7 mm in the above mentioned three groups, respectively, which makes a separation impossible.

To explain the disjunct pattern of distribution, Guppy (4, p. 449) believed that the seedlings of this species are not well fitted for long voyages across the Pacific Ocean: he assumed it to have been once widely distributed over the tropics of the Old and New Worlds, and now on the "down grade" towards extinction so leaving it in two widely separate areas in the Americas and in the West Pacific islands.

Hemsley (6) postulated that this species is "perhaps accidentally introduced with ballast in the Tonga Islands as well as in Stewart Island". This is not very likely as Forster already knew it from many islands. Ridley (12) also considered that this seems quite impossible, because of "the soft nature of the seedling"; he thought "it must have been drifted by sea to those Polynesian Islands from America, although the distance (at least 6,000 miles), seems a very long one. It may, however, have formerly established itself on some of the intermediate islands, and either been overlooked or has disappeared, from changes in these islands".

Guppy (4, p. 443—448) recorded a seedless form of *Rhizophora*, "*selala*" (= "the tree with empty flowers"), which is intermediate between *R. mangle* and *R. mucronata* and is nearest to *R. mucronata*. Because of its intermediate characters and seedless condition, he first thought that the "*selala*" is a cross between those two species, with *R. mucronata* as the female parent, "but there are several difficulties in accepting the explanations"; after studying the means of renovation of "*selala*", he was inclined to the view that it is due to the "dimorphism" of *R. mucronata*, one fertile and the other seedless. Salvoza (13, p. 219), basing himself

on the characters given for "*selala*" in Guppy's table on p. 445, described it as *R. mucronata* var. *selala*. He did not give it a Latin diagnosis and according to the Code, Art. 34, this new taxon has not been validly published.

Forster (1) recorded *R. mangle* from the Society Islands and New Caledonia. There is a Forster specimen in the Kew Herbarium, on the label said to have been collected in the Society Islands with the common name "*wabitatin malabar*". So far I could not find any other specimen or record of the genus from the Society Islands; the specimen might have been collected on some Melanesian island.

Vieillard (16) recorded *R. mangle* with doubt from New Caledonia. His specimen (431, P) has rightly been pointed out by Guillaumin (3) to belong to *R. mucronata* Lamk. There is another specimen collected by Balansa (3355, K, P) at Diahot, New Caledonia, dated April 1871, with incurved leaf tips and good inflorescences and flowers, which is clearly *R. mangle*.

6. *Rhizophora harrisonii* Leechm. For synonymy, references, and description see Keay, Kew Bull. 1953, 124 and Salvoza's revision p. 211. — *R. brevistyla* Salvoza, Nat. Appl. Sc. Bull. Un. Philip. 5, 1936, 211, t. 2; Gregory, Ann. Mo. Bot. Gard. 45, 1958, 140. — *R. racemosa* (non G. F. W. Mey.) Benth. in Hinds, Bot. Voy. H. M. S. Sulphur 4, 1844, 92.

This species is occurring in the mangrove swamps in the New World and West Africa.

Salvoza described *R. brevistyla* based on his own collection (1007, A) at Bella Vista, along the Pacific coast, Panama. According to him, this species can be distinguished from *R. racemosa* (non G. F. W. Mey.) Salvoza, which is *R. harrisonii* Leechm. (cf. Keay, l.c. 125), "by its relatively small flowers or flower-buds and short style coupled with the length of the peduncles". The type specimen which I had on loan from the Arnold Arboretum Herbarium has three branchlets, broken inflorescences, fallen leaves and a hypocotyl. Salvoza only cited the type collection and I wonder if he had any duplicate of it as his drawing does not agree with the type specimen I have had on loan. Plate 2 in his paper seems to have been constructed from memory as far as measurements are concerned, e. g. the length of peduncle and pedicel and the width of the leaves.

There are two other collections in the National Herbarium, U. S. A., collected in Panama, Pearl Archipelago, viz San José Island (Erlanson 13), and Saboga Island (G. S. Miller Jr 1963), which match the type. Erlanson 13 is a very good specimen with a very well preserved inflorescence bearing flowers in different stages of development. It is very similar to *R. harrisonii* by the lax inflorescences and the free parts of the bracteole-cup at the base of the flower being distinctly 2-lobed and deltoid, differing from the latter by the shorter (3—4 mm) pedicels and slightly broader, ellipsoid, acute to slightly blunt flower bud. The pedicels of *R. brevistyla* are cited by Salvoza to be 5—10 mm long in the original description and 3 to 4 mm long in his key. The latter size agrees with that of the type. The length of the pedicels in Gregory's description of this species is 3 to 10 mm; not having seen all the specimens quoted by

him, I do not know whether this is based on the measurements of the specimens cited. There are some specimens of *R. harrisonii* in the Botanical Museum and Herbarium, Utrecht, especially those collected by the Jonkers (570, 571, 573) and by F. P. Jonker (600) in Suriname, which are very well prepared and with good preserved inflorescences. The length of pedicels of those specimens varies from 4 to 10 mm.

Guppy (4, p. 445) in comparing the species of *Rhizophora* in Fiji and Ecuador, listed two "forms" in the latter. One form "*mangle chico*" is *R. mangle* L. The other form, "*mangle grande*", bears leaves "very obtuse, with no twisted point", inflorescences "branching at least three times, sometimes four or five times, trichotomous or dichotomous, twelve to forty-eight flowers", and "well developed" bracts and bracteoles; all these characters match those of the present species very well. Salvoza has referred it to the present species. Guppy (p. 498) also noticed the "*mangle grande*" of Ecuador to exist in the Panama isthmus.

Bentham (l. c.) as early as in 1844, recognized two species of *Rhizophora* on the Pacific coast of America "to be perfectly distinct".

I have examined three old specimens of *R. harrisonii*: two of them were collected by Hinds in 1836—42 at Corinto, west coast of Nicaragua (s. n., BM), and Realejo, west coast of Guatemala (s. n., CGE), respectively, and one was collected by Spruce (6387, K, P) at Chanduy, Ecuador, in 1865; the latter has pedicels 5—7 mm long. This species occurs in a few localities on the Pacific coast between Guatemala and Ecuador as indicated above. It will probably appear to be more common than can be inferred from the available collections; it might have been confused sometimes with *R. mangle*. The distributional gaps would be filled up if one could have an opportunity searching it in the field as well as looking through the herbarium material identified as *R. mangle* from the Pacific coast of America.

7. *Rhizophora racemosa* G. F. W. Meyer. For synonymy and references see Keay, Kew Bull. 1953, 125.

This species is occurring on the Atlantic shores of West Africa and the Americas. According to Keay (9), it is "the most frequent species on the African coast, but the least frequent on the American side". It is the only species which has not yet been found on the Pacific side of America.

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FLORAE MALESIANAE PRECURSORES XXV
NOTES ON MALAYSIAN AND SOME S. E. ASIAN
CYPERACEAE VIII ¹⁾

by

J. H. KERN

(Rijksherbarium, Leiden)

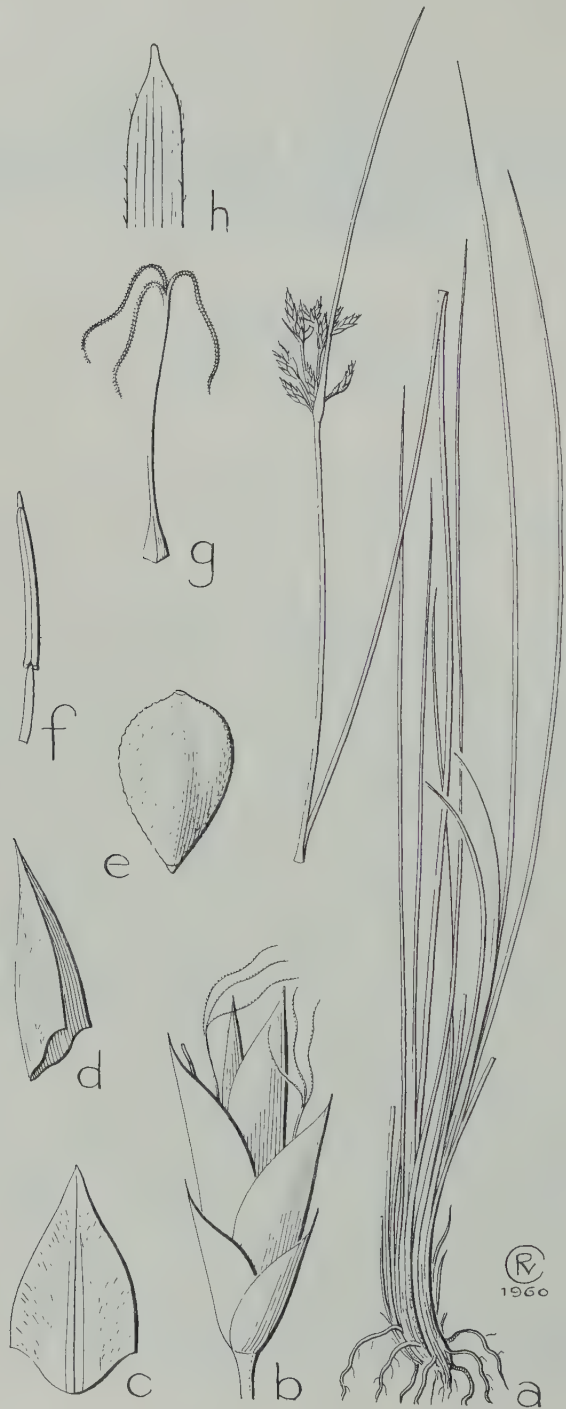
(Issued 1. XII. 1960)

I. NOVELTIES IN FIMBRISTYLIS

1. *Fimbristylis savannicola* Kern, spec. nov. — *Sect. Fuscae* Ohwi.
— *Fig. 1.*

Herba perennis, rhizomate lignoso brevissimo vaginis brunneis parce dissolutis circumdato. *Culmi* caespitosi, erecti, graciles sed firmuli, compressi, sulcati, dense puncticulati, glabri laevesque vel praesertim basin versus pilis albis patentibus antrorsisve pubescentes, 20—40 cm alti, $\frac{2}{3}$ —1 mm crassi, ad basin incrassatam foliati. *Folia* erecta, rigida, setacea, canaliculato-conduplicata, apice abrupte acuminata, supra minute celluloso-reticulata, subtus costata, cinereo-viridia, pilis albis antrorsis dense pubescentia, $\frac{1}{2}$ —1 mm lata, laminis intus ad basin serie pilorum alborum a vagina separatis; vaginae striatae, cinnamomeae, antice membranaceae. *Anthela* subsimplex, densa, 1—2 $\frac{1}{2}$ cm longa, 1—2 cm lata. *Bractee involucales* 3—5, setaceae, pubescentes, ima foliis consimilis, erecta, basi dilatata, inflorescentiam superans, 2—7 cm longa, ceterae multo breviores. *Radii anthelae* 3—6, breves, applanati, glabri vel pubescentes, denique patentes vel arcuato-reflexi, usque ad 1 $\frac{1}{2}$ cm longi. *Spiculae* in apice radorum (1—)2—6, dense aggregate, lanceolatae, valde compressae, acutiusculae, 2—4-florae, 4—5 mm longae, c. 2 mm latae. *Rhachilla* late alata. *Glumae* distiche dispositae, tenuiter membranaceae, erectae, ovatae, acuminatae, acutae, muticae, nervo medio prominente acute carinatae, fuscae, lateribus dilutioribus dense glanduloso-puncticulatis, 4—4 $\frac{1}{2}$ mm longae, c. 2 $\frac{1}{2}$ mm latae, inferiores 2 vacuae, minores, mucronulatae. *Stamina* 3, antheris linearibus, c. 2 mm longis, connectivo in appendicem brevem rubram laevem producto. *Stylus* tenuis, triquetrus, ad basin pyramidato-incrassatus, glaber, 3—3 $\frac{1}{2}$ mm longus, stigmatibus 3 quam stylus brevior-

¹⁾ Part I in Reinwardtia 2, 1952, 97—130; II in Reinwardtia 3, 1954, 27—66; III in Blumea 8, 1955, 110—169; IV in Reinwardtia 4, 1956, 86—97; V in Blumea 9, 1958, 215—236; VI in Blumea Suppl. 4, 1958, 163—169; VII in Acta Botanica Neerlandica 7, 1958, 786—800.



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ribus. *Nux* obovata, obtuse trigona, leviter tricostata, breviter stipitata, vix umbonulata, dense verruculosa, primo albida, denique straminea, c. 1 mm longa, $\frac{2}{3}$ mm lata, cellulis extimis fere isodiametricis indistincte puncticulata.

THAILAND. Udawn, Lôi, Pu-Tong, in savannah, c. 1100 m, local name Yā nuat mêu, March 28, 1924: *A. F. G. Kerr 8862* (type; K).

By its distichous, gland-dotted glumes this species suggests close affinity with *F. cinnamometorum* (Vahl) Kunth, *F. fuscoides* C. B. Clarke, and *F. adenolepis* Kern. In *Sect. Fuscae* it stands, however, apart on account of the clustered spikelets, the presence of a row of hairs representing the ligule, and the striking indument.

2. *Fimbristylis leptoclada* Benth. var. *etuberculata* Kern, var. nov.
Nux cellulis extimis distincte reticulata, sed non tuberculata.

NEW GUINEA. W. New Guinea, Tanah Merah, on aerodrome, 15 m, May 29, 1959: *B. O. van Zanten 1032* (type; L).

The species is new for New Guinea. In all specimens from Ceylon, continental Asia, and Western Malaysia I have seen, the nuts are densely verruculose.

3. *Fimbristylis jucunda* (C. B. Clarke) Kern, comb. nov. — *Cyperus jucundus* C. B. Clarke, Kew Bull., add. ser., 8, 1908, 3. — T.: Tonkin: *Balansa 1812* (K). — *Fimbristylis brunnea* C. B. Clarke ex E. G. Camus, Notulae Syst. 1, 1910, 248. — T.: Tonkin: *Balansa 1812* (P); Laos: *Thorel s.n.* (P).

The name *Fimbristylis brunnea*, given by C. B. Clarke to the specimens of *Balansa 1812* in the Paris Herbarium, was published after Clarke's death by E. G. Camus. It is difficult to understand that a specimen of the same collection in the Kew Herbarium was annotated by Clarke as "*Cyperus jucundus*, C. B. Clarke ms.", for the plants doubtless belong in *Fimbristylis*, not in *Cyperus*. Also the latter binary combination was published posthumously. As the name *Cyperus jucundus* has priority by two years, the correct name in *Fimbristylis* is *F. jucunda* (C. B. Clarke) Kern.

Kükenthal, in Fedde Rep. 18, 1922, 345, still treated the species as belonging in *Cyperus*. For reasons unknown to me he reduced it in Pflanzenr. Heft 101, 1936, 629, wrongly to the synonymy of *Fimbristylis hookeriana* Boeck.

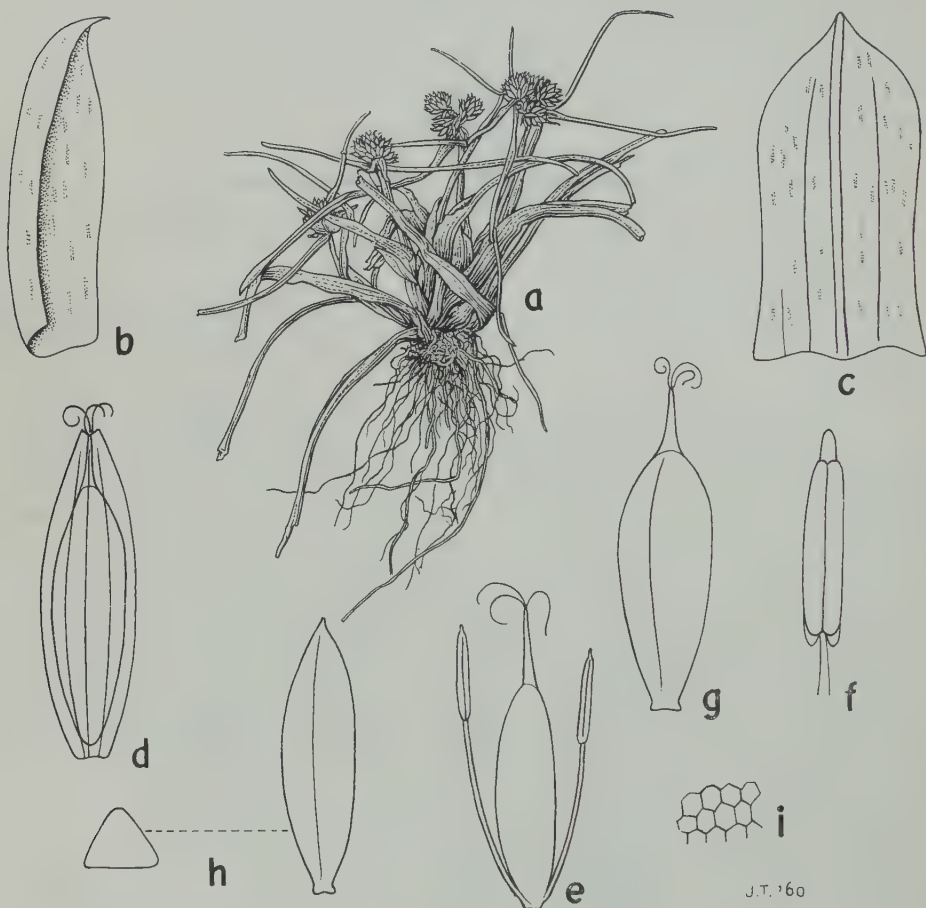
The two sheets of this *Balansa* collection in the Leiden Herbarium, both labelled "○ Laisses de la Rivière-Noire à Tu-Phap, mai 1888", have been differently numbered (1812 and 2812).

Fig. 1. *Fimbristylis savannicola* Kern — a. Habit, $\times \frac{3}{4}$; b. spikelet, $\times 7\frac{1}{2}$; c, d. glumes, $\times 7\frac{1}{2}$; e, nut, $\times 25$; f. stamen, $\times 10$; g, style, $\times 10$; h, tip of leaf, $\times 10$. — From *Kerr 8862*.

II. A NEW LIPOCARPHA FROM CAMBODIA

Lipocarpus pygmaea Kern, spec. nov. — Sect. *Lipocarpus*. — Fig. 2.

Herba annua, pumila, glabra, radicibus fibrosis pertenuibus. Culmi singuli vel fasciculati, erecti vel oblique erecti, firmuli, subteres, laeves, 1—3 cm alti, $\frac{1}{2}$ —1 mm crassi, basi foliis paucis et cataphyllis nonnullis



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Fig. 2. *Lipocarpus pygmaea* Kern — a. Habit, $\times 1$; b, c. glumes, $\times 25$; d. flower, enclosed in squamellae, $\times 25$; e. flower, $\times 25$; f. stamen, $\times 50$; g. pistil, $\times 25$; h. nut with transverse section, $\times 25$; i. epidermal cells of nut. — From Van Steenis 19587.

nervosis stramineo-fuscis circumdati. *Folia* linearia, culminibus aequilonga longiorave, rigida, saepe curvata, carinato-plana, acutiuscula, laevia, eligulata (basi laminae intus sensim in vaginam transeunte), 1—2 mm lata; vaginae inferiores ferrugineae vel brunneae, nervosae, marginibus membranaceae. *Inflorescentia* capitata, e spiculis 1—3 dense congestis composita,

5—6 mm lata, 3—5 mm alta. *Bracteae involucales* 1—3, patentes, basi conspicue dilatatae, ima foliis consimilis, inflorescentiam multo superans, usque ad $2\frac{1}{2}$ cm longa, ceterae breviores. *Spiculae* parvae, sessiles, late ovoideae, obtusae, pluriflorae, 2—4 mm longae et latae. Rhachilla conoidea, $\frac{2}{3}$ mm crassa. *Glumae* spiraliter dispositae, undique imbricatae, deciduae, oblongae, haud vel vix spathulatae, carinatae, apice plerumque subeuculatae, obtusae, lineolis fuscis conspersae, 3- vel sub-5-nerviae (nervo medio crasso, nervis lateralibus obsoletis), c. 2 mm longae, fere 1 mm latae. *Squamellae* 2, ellipticae, hyalinae, $1\frac{2}{3}$ mm longae, posteriore anteriorem amplectente. *Stamina* 1(—2), antheris oblongo-linearibus, breviter apiculatis, $\frac{1}{2}$ mm longis. *Stylus* brevis, $\frac{1}{3}$ mm longus, stigmatibus 3. *Nux* squamellis subaequilonga, oblongo-linearis, regulariter trigona, breviter stipitata, minute apiculata, certe haud rostrata, dense subtiliter puncticulata, cellulis extimis hexagonalibus reticulata, straminea, $1\frac{1}{2}$ mm longa, $\frac{1}{3}$ mm lata.

INDOCHINA, Cambodia, Siem Reap, on hard soil near aerodrome, alt. c. 100 m, Dec. 1957: *van Steenis 19587* (L, type; dupl. in K).

Closely related to *Lipocarpa sphacelata* (Vahl) Kunth, but satisfactorily separable by the dwarfish habit, the leaves at least partly overtopping the flowering stems, the oblong glumes not strongly broadened towards the apex, and the longer, erostrate nut with much less conspicuous stipe. In *L. sphacelata* the nut proper is 1 mm long, broadly stipitate, and crowned by a dark brown, c. $\frac{1}{3}$ mm long beak.

III. TWO CYPERACEAE NEW FOR MALAYSIA

1. ***Scirpus aucklandicus*** (Hook. f.) Boeck., *Linnaea* 36, 1870, 491; S. T. Blake, *Proc. R. Soc. Queensl.* 58, 1947, 39. — *Isolepis aucklandica* Hook. f., *Fl. Antaret.* 1, 1844, 88, t. 50; Steud., *Syn.* 2, 1855, 92; Hook. f., *Handb. N. Zeal. Fl.* 1867, 302.

MALAYSIA. N.E. New Guinea, Hagen Subdistr., Western Highlands, Mt Hagen, 10,900 ft, in tussock grassland, edge of alpine swamp, July 9, 1957: *R. G. Robbins 359* (CANB).

Scirpus aucklandicus belongs to a group of closely related, small species, of which *S. merrillii* (Palla) Kük. ex Merr. and *S. inundatus* (R. Br.) Poir. have already been recorded for Malaysia. It is nearest to *S. merrillii*, but usually somewhat stouter, and differs moreover by the spikelet partly hidden by the strongly dilated base of the involueral bract, the keeled larger glumes, the 3 stamens, the slightly longer anthers with distinctly produced connective, and the somewhat larger nuts. Previously it was known from Australia (N. S. Wales, Victoria, Tasmania), New Zealand and its outlying islands, and Amsterdam Island (see Blake, l.c.).

2. ***Schoenus nitens*** (R. Br.) Poir., *Enc. Suppl.* 2, 1811, 252; Hook. f., *Handb. N. Zeal. Fl.* 1867, 299; Benth., *Fl. Austr.* 7, 1878, 362; Black, *Fl. S. Austr.* 1, 1922, 91; ed. 2, 1948, 151; Kük. in Fedde, *Rep.* 44, 1938, 162. — *Chaetospira nitens* R. Br., *Prodr.* 1810, 233. — *Scirpus nitens* (R. Br.) Boeck., *Linnaea* 36, 1870, 696.

MALAYSIA. W. New Guinea, 11 km NE of Wilhelmia top, 3400 m, wet grassy western slope, Sept. 1938: *Brass & Meijer Drees 9724* (BO; L, p.p.).

This collection, cited by S. T. Blake in J. Arn. Arb. 29, 1948, 92, under his new species *Schoenus setiformis*, appears to be a mixture of this species and *Schoenus nitens* (R. Br.) Poir. The sheet in the Leiden Herbarium contains both *S. setiformis* and *S. nitens*, that in the Bogor Herbarium only *S. nitens*.

Schoenus nitens is a dwarf species with a capitate inflorescence consisting of a few spikelets only. This inflorescence is pseudolateral because of the stiffly erect lowest involucre bract. The species can readily be distinguished from all other Malaysian *Schoeni* by its creeping rhizome, and particularly by the perianth bristles plumose in the lower part. It is common throughout Australia and New Zealand.

IV. THE IDENTITY OF *SCHOENUS FUSCO-GUTTATUS* OHWI

This species was published in Bot. Mag. Tokyo 56, 1942, 206. The type is from W. New Guinea: Waren, 60 miles S of Manokwari: *Kanehira & Hatusima 13163*. A juvenile collection from the same locality was also cited.

According to Ohwi *Schoenus fusco-guttatus* is an ally of *S. neoguinensis* Kük. It is said to differ from the latter by the short leaves, the sheaths bearded at the mouth, and the larger number of glumes (8—9 in *S. fusco-guttatus*, 4 in *S. neoguinensis*). From Ohwi's description it is already clear that the true affinity of *S. fusco-guttatus* is with the members of *Sect. Nudicaules*: leaf-sheaths bearded at the mouth, bract bladeless and pilose at the mouth, glumes 8—9, hairy on the margins. The specimens of both collections in the Bogor Herbarium belong to *Schoenus sparteus* R. Br., in which species the leaves are frequently less reduced than in the other *Nudicaules*, and sometimes attain a rather considerable length. The specific epithet *fusco-guttatus* refers to the brownish punctulation of the glumes, a characteristic feature in *S. sparteus*.

V. SOME ADDITIONAL CORRECTIONS ON CAMUS'S REVISION OF THE CYPERACEAE OF INDO-CHINA

In Kükenthal's monographic studies on *Cypereae* and *Rhynchosporoideae* the data for the Indochinese region have been taken from Camus's treatment of the *Cyperaceae* in Lecomte, Flore Générale de l'Indo-Chine vol. 7. As this treatment is rather uncritical, and Kükenthal did not see the material on which it was based, the Indochinese records are often unreliable. Several reductions of Camus's records have already been made by Raymond and in my previous papers; some others follow here. The collectors' numbers, not cited by Camus, have been added in brackets.

1. ***Kyllinga squamulata*** (non Vahl) Camus, Fl. Gén. I.-C. 7, 1912, 26. — Tonkin, Do-xa: *Bon (4110)*. — In Asia the widely distributed *Cyperus metzii* (Hochst. ex Steud.) Mattf. & Kük. (= *Kyllinga squamu-*

lata Vahl) is known from India. Camus's record refers to a collection of *Cyperus pygmaeus* Rottb.

2. ***Pycreus flavescens*** (non Rehb. nec Nees) Camus, l.c., p. 28. — Cochin China, Saigon: *Pierre, Germain* (80). — *Cyperus flavescens* L. [= *Pycreus flavescens* (L.) Rehb.] extends eastward as far as the Western Himalaya and certainly does not reach Farther India. The cited Germain collection is a mixture of *Cyperus pumilus* L., *C. sulcinus* C. B. Clarke, and a very poor specimen possibly referable to *C. rotundus* L.

3. ***Pycreus pumilus* Nees var. *substerilis*** E. G. Camus, Not. Syst. 1, 1910, 240; Fl. Gén. I.-C. 7, 1912, 33. — Cochin China: *Pierre* (s.n.). — This collection is a mixture of typical *Cyperus pumilus* L. and *C. brevifolius* (Rottb.) Hassk. As Camus's description "spiculae numerosae, pauciflorae, floribus saepe sterilibus" was obviously drawn up from the specimens belonging to *C. brevifolius*, these may be the lectotype of the variety.

4. ***Pycreus baccha*** (non Nees) Camus, Fl. Gén. I.-C. 7, 1912, 36. — Cochin China: *Thorel* (533). — *Cyperus puncticulatus* Vahl (= *Pycreus baccha* Nees) is only known from India and Ceylon. The records for Malacca and Perak in Ridley's Flora of the Malay Peninsula 5, 1925, 140, refer to the much more widely distributed *Cyperus procerus* Rottb., which species is not rarely mistaken for *C. puncticulatus*, because of the rather similar facies. *Cyperus procerus* is not a *Pycreus* and can readily be distinguished from *C. puncticulatus* by the triquetrous — not biconvex — nuts. Also Thorel 533 belongs to *C. procerus* Rottb.

5. ***Cyperus amabilis*** (non Vahl) Camus, l. c., p. 45. — Cochin China, Saigon: *Lefèvre* (s.n.). — *Cyperus amabilis* Vahl is widely distributed in tropical Africa and tropical America. In Asia it seems to be restricted to India. The collection cited by Camus belongs to *C. castaneus* Willd.

6. ***Cyperus silletensis*** (non Nees) Camus, l. c., p. 47. — Annam, Nha-trang: *Robinson* (1254). — This is a young specimen of *Cyperus pulcherrimus* Willd. ex Kunth.

7. ***Cyperus fuscus* L.**; Camus, l. c., p. 48. — The specimen from Tonkin, vers Ninh-binh: *Bon* (1919), belongs to *Cyperus sanguinolentus* Vahl ssp. *sanguinolentus*.

Cyperus fuscus L. var. *pallido-marginatus* E. G. Camus, l. c., p. 49, was based on a collection from Laos, Kemmerath: *Thorel* (2889), wrongly cited in the Flore Générale under *C. fuscus* var. *virescens*. This collection represents a remarkable race of *C. fuscus*, with almost black sides of the glumes, fruits slightly larger than in typical *C. fuscus*, and somewhat longer style. This race occurs also in Southern China, for *Cyperus duclouxii* E. G. Camus, Not. Syst. 1, 1910, 244, from Yun-nan: *Ducloux* 3639, is certainly convarietal. According to Camus *Cyperus duclouxii* should be near to *C. diffusus* Vahl and for this reason Kükenthal wrongly placed it in *Sect. Diffusi* (see Pflanzenr. Heft 101, 1936, 215).

8. ***Cyperus flavidus* Retz. var. *africanus*** E. G. Camus, l. c., p. 51. — Cochin China, Saigon: *Germain* (s.n.); Annam, Tourane and Hué:

Lecomte & Finet (s.n.). — I do not understand why the authority of this variety is ascribed to "Rotth., Deser. et Icon. tab. 6, f. 2, ex Clarke." Presumably the collections cited by Camus have to be considered the base of the variety. They belong all to *Cyperus haspan* L.

9. *Cyperus leucocephalus* (non Retz.) Camus, l. c., p. 51. — Laos, bassin du Sé-moun: *Harmand (s.n.)*; Cochin China: *Pierre (s.n.)*. — Both collections belong to *Cyperus niveus* Retz.

Cyperus leucocephalus does occur in Indo-China; it is the plant described by Camus as *Kyllinga pierreana* (P; see Reinw. 3, 1954, 42).

10. *Cyperus kurzii* (non Clarke) Camus, l. c., p. 54. — Cochin China: *Thorel s.n.* — *Cyperus kurzii* C. B. Clarke is so far only known from the type collection: Andamans, Phaeacia, *leg. Kurz* (K!). The Thorel specimen certainly does not belong to this species, but to *Cyperus diffusus* Vahl.

11. *Cyperus helferi* (non Boeck.) Camus, l. c., p. 55. — Cambodia, Pnom-penh: *Magnien, Gourgand & Châtillon (s.n.)*; Kampot: *Geoffray (33)*. — Both collections belong to *Cyperus trialatus* (Boeck.) Kern (= *C. bancanus* Miq.).

12. *Cyperus squarrosus* (non L.) Camus, l. c., p. 58. — Cochin China: *Talmy (s.n.)*. — In all probability this is not a Talmy collection, but a duplicate of *Baudouin* 69, and like this collection it belongs to *Cyperus cuspidatus* Kunth.

The sheet in the Linnaean Herbarium marked "*squarrosus*" in Linné's handwriting contains two species, one of them represented by a tuft of complete plants, the other by a single inflorescence. Only the complete specimens answer Linné's original description in Cent. Pl. 2, 1756, 6. They belong to the species generally referred to as *Cyperus aristatus* Rotth., the correct name of which consequently is *Cyperus squarrosus* L. Camus, and also Kükenthal, Pflanzenr. Heft 101, 1936, 505, followed Clarke in J. Linn. Soc., Bot. 30, 1894, 305, who wrongly applied Linnaeus's name to the species represented by a single inflorescence. Apparently the earliest name of the latter species is *Cyperus maderaspatanus* Willd.

The only Indochinese collection of *C. maderaspatanus* I have seen in the Paris Herbarium is that of Gaudichaud (sub no 73), according to the label originating from Cochin China, near Tourane, in 1837.

13. *Cyperus iria* L. var. *microiria* (non Franch. & Savat.) Camus, l. c., p. 59. — Tonkin: *d'Alleizette (s.n.)*; Cochin China: *Germain (s.n.)*. — Both collections represent *Cyperus iria* L., not the E. Asiatic *C. microiria* Steud. [= *C. iria* L. var. *microiria* (Steud.) Franch. & Savat.], which is undoubtedly specifically distinct from the former.

14. *Cyperus bulbosus* (non Vahl) Camus, l. c., p. 64. — Cochin China, Saigon, jardin: *Lecomte & Finet (2031)*; Tonkin, vers Ninh-binh: *Bon (5613)*; baie de Fit-tsi-long: *Balansa (199)*. — *Cyperus bulbosus* Vahl, widely distributed in the tropics and subtropics of the Old World, from the Mediterranean region and tropical Africa to India, and also known from Australia, is apparently extremely rare in S.E. Asia. In Malaysia

it has only a few times been collected (Island of Damar Besar in the Bay of Djakarta, Madura, and Timor). Of the collections cited by Camus, that of Lecomte & Finet belongs to *Cyperus rotundus* L., the other ones all to *C. stoloniferus* Retz.

Cyperus bulbosus var. *elatus* E. G. Camus, Not. Syst. 1, 1910, 244; Fl. Gén. I.-C. 7, 1912, 65. — Cochin China, Ha-tien: Godefroy (759), must be referred to the synonymy of *C. stoloniferus* Retz.

15. *Cyperus longus* (non L.) Camus, Fl. Gén. I.-C. 7, 1912, 68. — Cochin China: Pierre (*s.n.*). — *Cyperus longus* L., is a mainly mediterranean-atlantic species and does not extend to S.E. Asia. The specimens cited by Camus belong to *Cyperus corymbosus* Rottb.

16. *Cyperus elatus* (non L.) Camus, l. c., p. 70. — The numerous collections cited by Camus belong to *Cyperus digitatus* Roxb., except for that from Ninh-binh: Bon (1487), which is *C. stenophyllus* Valek. Sur.

Cyperus elatus L. var. *macronux* (non Clarke) Camus, l. c., p. 72. — Cochin China: Germain (65), is *C. exaltatus* Roxb.

Cyperus elatus L. var. *laxus* E. G. Camus, Fl. Gén. I.-C. 7, 1912, 172; Kük., Pfl. R. Heft 101, 1935, 60. — Type from Cochin China: Baudouin (*s.n.*). — This is *Cyperus digitatus* Roxb.

17. *Cyperus radiatus* (non Vahl) Camus, l. c., p. 72, f. 9, 1—4. — All collections cited by Camus belong to *C. elatus* L.

18. *Cyperus exaltatus* (non Retz.) Camus, l. c., p. 72. — Cochin China: Talmy (*s.n.*); Xien-cong: Thorel (*s.n.*). — The Talmy collection belongs partly to *Cyperus elatus* L., partly to *C. digitatus* Roxb., the Thorel collection to *C. imbricatus* Retz.

Cyperus exaltatus Retz. var. *dives* (non Clarke) Camus, l. c., p. 74. — This is *C. exaltatus* Retz., except for the collection from Long-tehéou: Simond (*s.n.*), which is *C. iria* L.

19. One of the collections cited by Camus, l. c., p. 85, under *Eleocharis atropurpurea* (Retz.) Presl, viz Cochin China: Thorel (474), belongs to *Eleocharis parvula* (R. & S.) Link ex Bluff, Nees & Schauer. This is the third station of this species in E. Asia. In this region it was previously only known from Japan (Kiushiu) and E. Java (Bangil). See Reinwardtia 4, 1956, 94.

20. *Scirpus setaceus* (non L.) Camus, l. c., p. 132. — Annam, Hué: Lecomte & Finet (1277). — Is *Bulbostylis puberula* (Poir.) Clarke. *Scirpus setaceus* L. is not very likely to occur in Annam.

21. The genus *Fuirena* is represented in Malaysia by two species only, *F. umbellata* Rottb. and *F. ciliaris* (L.) Roxb. This is apparently also the case in Indo China, as the records of *F. wallichiana* and *F. uncinata* (Camus, l. c., p. 141) properly belong to *F. ciliaris* and *F. umbellata* respectively.

22. *Lipocarpus triceps* (non Nees) Camus, l. c., p. 144. — Cochin China, Phuoc tan: Thorel (563). — Is *Lipocarpus chinensis* (Osb.) Kern [= *L. senegalensis* (Lamk) Durand].

23. *Rhynchospora massieana* E. G. Camus, Not. Syst. 1, 1910, 249; Fl. Gén. I-C. 7, 1912, 147; Kük., Bot. Jahrb. 74, 1949, 500. — Cochin China: *Pierre* (s.n.); Laos: *Massie* (s.n.). — *Rhynchospora massieana* is said to differ from *R. longisetis* R. Br. by the nuts slightly broader at the top and the hypogynous bristles scabrous throughout. However, I fail to see any difference between the two. In Kükenthal's opinion Camus's description agrees fairly well with that of *Rhynchospora heterochaeta* S. T. Blake, but the latter is inaccurate, as "capitulum 12—15 mm diametro" should read "spiculae 12—15 mm longae" and "setae hypogynae.... achaenium cum mucrone aequantes" does not agree with the type material, in which the bristles conspicuously overtop the persistent style-base.

24. *Neolophocarpus tonquinensis* (Boeck.) E. G. Camus, Fl. Gén. I-C. 7, 1912, 149. — Tonkin, vers Ninh-binh: *Bon* (2630). — The generic name *Neolophocarpus* E. G. Camus, l. c., p. 148, is a nomen novum for *Lophocarpus* Boeck., Allg. Bot. Zeitschr. 2, 1896, 110, non Link. *Neolophocarpus tonquinensis* was based on *Lophocarpus tonquinensis* Boeck., l. c., p. 111. Kükenthal, in Fedde Rep. 44, 1938, 24, rightly reduced Boeckeler's species to *Schoenus falcatus* R. Br. So nomenclaturally *Neolophocarpus tonquinensis* must also be referred to the synonymy of *Schoenus falcatus*, though the collections in the Paris Herbarium named by Camus all belong to *Cladium mariscus* (L.) Pohl.

25. *Machaerina vaginalis* (Benth.) Koyama (*Cladium vaginale* Benth.) is restricted to Australia. The records for Indo-China (Camus, l. c., p. 153) refer to *Leptocarpus disjunctus* Mast. (see also Fl. Mal. I, 5, 1957, 419).

VI. MISCELLANEOUS NOTES AND NEW RECORDS, MOSTLY FROM THAILAND AND MALAYSIA

1. *Cyperus diaphanus* Schrad. ex R. & S. (1824). — This is the species generally known as *Cyperus latespicatus* Boeck. (1859). Although the specimens of the type collection (from Nepal, Wallich, K) are immature, they certainly belong here, as was already stated by Clarke, Fl. Br. Ind. 6, 1893, 590. Kükenthal, in Pfl. R. Heft 101, 393, treated *C. diaphanus* as a variety of *C. latespicatus*, which procedure is contrary to the Code.

N.E. THAILAND. Loei, Phu Krading, in savannah, 1300 m: *Smitinand* 5953 (L).

2. *Cyperus leucocephalus* Retz. See Reinwardtia 3, 1954, 44.

THAILAND. N. Mae Hawng Sawn, in dry dipterocarp forest, 400 m: *Smitinand* 4568 (L); N.E. Loei, Wang Saphung, Sithan, 300 m: *Dec* 2 (*RFD* 4907); Khawnkaen, Chumpae, by roadsides in sandy soil, 250 m: *Smitinand* 5836 (L); E. Srisaket, Kantharom, in scrub jungle, 200 m: *Smitinand* 588 (*RFD* 5136) (L); S.W. Kanburi, Pa-pu-thong, mixed forest, 165 m: *Bunnak* 841 (L); S.E. Chantburi, Makham, along edge of thicket, 20 m: *Smitinand* 5743 (*RFD* 21509) (L); same locality, in the plain, 130 m: *Bunnak* 231 (*RFD* 9647) (L).

3. *Cyperus niveus* Retz.

N. THAILAND. Mae Hawng Sawn, in dry dipterocarp forest, 400 m: *Smitinand* 4571 (L).

4. *Cyperus pachycephalus* Kern, Reinwardtia 2, 1952, 119.

NEW GUINEA. Div. W. New Guinea. Vogelkop Peninsula, Lake Ajamaru, very common on peaty mud, 250 m, local name "sera" (Maibrat language): *Versteegh BW 7360* (L).

5. *Cyperus sphacelatus* Rottb. — Introduced from tropical Africa or America, now rapidly spreading in the tropics of Asia, Australia, and Oceania. See Reinwardtia 2, 1952, 107; Blumea 8, 1955, 162; *ibid.* 9, 1958, 234.

SUMATRA. East Coast. Pematang Siantar, in 1953: *L. Otto 16, 21, 43* (L).

BORNEO. Brunei. Belait Distr., Badas F. R., very common in *Shorea albida* peat swamp, in 1958: *Jacobs 5698* (L).

NEW BRITAIN. Gazelle Peninsula: *Kingston 24* (LAE).

QUEENSLAND. S. Johnstone, roadside, in 1953: *Kingston K 49* (LAE).

6. *Cyperus unioides* R. Br.

N.E. THAILAND. Loei, Phu Krading, in savannah, 1300 m: *Smitinand 1952, 5845, 5933* (L).

7. *Fimbristylis adenolepis* Kern, Blumea 8, 1955, 123.

THAILAND. Aran Pratet, in open, low-lying, grassy ground, 50 m: *Kerr 19566* (K).

8. *Fimbristylis cinnamometorum* (Vahl) Kunth.

THAILAND. N. Phetchabun, Lamkao, Phu Hee, in oak forest, 860 m: *Smitinand 2595* (L); N.E. Loei, Phu Krading, in savannahs, 1300 m: *Smitinand 5946* (L); E. Srisaket, Kantharom, in open scrub jungle, 200 m: *Smitinand 585 (RFD 4934)* (L); S.E. Chanturi, Makham, along edge of thickets, 20 m: *Smitinand 5757* (L); Trat, Huay Raeng, Dong Maduae, among grasses in rice-field, under 50 m: *Smitinand 1331 (RFD 6772)* (BKF). Pen. Kanchanadit, Surat, in savannah, 5 m: *Kerr 13067* (K).

9. *Fimbristylis disticha* Boeck. See Blumea 8, 1955, 130.

C. THAILAND. Nakhawn Nayok, on the way to Nang Nawng, in rocky ground, 100 m: *Smitinand 6083* (L).

10. *Fimbristylis falcata* (Vahl) Kunth.

THAILAND. Ta Salao, Kanburi, in open scrub: *Kerr 19524* (K).

11. *Fimbristylis fusca* (Nees) C. B. Clarke.

THAILAND. N. Lampang, Ngao, Mae Huat, in deciduous forest, 360 m: *Amnat 57 (RFD 11275)* (L); N.E. Loei, Phu Krading, in open pine forest: *Dee 327 (RFD 4908)* (L); same locality, in savannahs, 1300 m: *Smitinand 5851 (RFD 21491)* (L), 5947 (L); S.W. Kanburi, Pa-Chan-dai, in mixed forest: *Bunnak 844* (L); S.E. Chanturi, Makham, in thickets, 20 m: *Smitinand 5755* (L).

12. *Fimbristylis fuscinox* C. B. Clarke, Fl. Br. Ind. 6, 1893, 638; J. Linn. Soc., Bot., 34, 1898, 60; Prain, Beng. Pl. 2, 1903, 1151 & 1154; Parker, Fl. Upper Gang. Plain 3³, 1929, 354. — Descr. emend. — Fig. 3, a-i.

Herba perennis, fere glabra, rhizomate brevissimo caespitoso. Culmi fasciculati, rigidi, compressi, obtuse angulati, striato-sulcati, glabri laevesque, 25—60 cm alti, inferne $1\frac{1}{2}$ —2 mm apice 1 mm crassi, ad basin incrassatam vaginis fuscis opacis demum in fibras dissolutis obtecti. Folia basalia tantum extant, culminibus duplo breviora, rigida, coriacea, erecta, plana, supra celluloso-reticulata, subtus costato-striata, apice abrupte acuminata, intus basi sensim in vaginam transeuntia eligulata, glabra, $1\frac{1}{2}$ —2 $\frac{1}{2}$ mm lata, marginibus sursum antrorse scaberulis; vaginae antice hyalinae, ore cilio-



latae. *Anthela* composita, laxa, angusta, c. 15—35-spiculata, 6—15 cm longa. *Bracteae involucales* inflorescentia multo breviores, erectae, ad basin dilatam scarioso-marginatae, ima usque ad $2\frac{1}{2}$ cm longa. *Anthelae radii* 8—12, graciles, oblique erecti, compressi, laeves, usque ad 5 cm longi, radioli capillares, c. 1 cm longi. *Spiculae* solitariae, ovoideae vel oblongae, subangulatae, acutiusculae, dense multiflorae, 5—7 mm longae, $2\frac{1}{3}$ —3 mm latae, demum elongatae, usque ad 20 mm longae. *Rhachilla* alata, fusca. *Glumae* spiraliter dispositae, membranaceae, erecto-patentes, ovatae, acutae, carinatae, nervo medio prominente in mucronem $\frac{1}{5}$ mm longum desinente, carina viridula, lateribus ferrugineo-fuscis, marginibus late albo-hyalinis, glabrae vel apice vix puberulae et sub microscopio ciliolatae, 2 mm longae, $1\frac{1}{2}$ mm latae. *Stamina* (1—)2; antherae oblongo-lineares, $\frac{1}{2}$ mm longae, minute apiculatae. *Stylus* tenuis, compressus, glaber, $\frac{2}{3}$ mm longus, basi dilatata fuscus, stigmatibus 2, stylo paullo longioribus. *Nux* biconvexa, valde compressa, ambitu late obovata vel suborbicularis, late breviterque stipitata, haud vel vix umbonulata, laevis, primo straminea, denique fusca vel nigricans, c. 1 mm longa et lata, cellulis minutis isodiametricis obsolete reticulata.

This little-known species is endemic in Moradabad and Sikkim Terai. Clarke placed it next to *Fimbristylis ferruginea* (L.) Vahl, but to me it is not closely related to this species. The emended description given above, which is based on the type at Kew, may show that it should be placed in *Sect. Cymosae* Ohwi. The densely tufted stems many-leaved at the incrassate base, the eligulate leaves, the spikelets slightly angular by the keeled glumes, the distinctly winged rhachilla, the very small anthers, the short glabrous style, and the blackish nut, point all to its affinity with *Fimbristylis cymosa* R. Br., especially with the digynous form of this species, often known as *F. spathacea* Roth.

13. *Fimbristylis fuscoides* C. B. Clarke.

S.E. THAILAND. Chanburi, Makham, common in the plain, 20 m: *Smitinand* 5741 (RFD 21510) (L.).

14. *Fimbristylis gracilentia* Hance. See Blumea 8, 1955, 144.

THAILAND. N.E. Loei, Phu Krading, in savannah, 1300 m: *Smitinand* 1941, 5888 (L). C. Nakhawn Nayok, on the way to Nang-Nawng, in rocky ground: *Smitinand* 6084 (L.).

In n. 6084 the lower, spirally arranged glumes have fallen off, the upper ones still attached to the rhachilla are regularly 2-ranked.

15. *Fimbristylis lasiophylla* Kern, Blumea 8, 1955, 115.

INDO-CHINA. Annam, prov. de Quang Binh, village de Tach Xa Xa, dunes sablonneuses très sèches: *Pételot* 5316, 5317 (P); prov. de Quang Ngai, Long Tri, dune

Fig. 3. *Fimbristylis fuscinox* C. B. Clarke — a. Habit, $\times \frac{1}{2}$; b. spikelet, $\times 5$; c, d. glumes, $\times 15$; e. anther, $\times 30$; f. deflorate flower, $\times 15$; g, h. nuts, $\times 15$; i. epidermal cells of nut. — From T. Thomson 205. — *Fimbristylis yunnanensis* C. B. Clarke — j. habit, $\times \frac{1}{2}$; k. rhizome, $\times \frac{1}{2}$; l. spikelet, $\times 5$; m. spikelet, some glumes removed to show wings of rhachilla, $\times 5$; n, o. glumes, $\times 5$; p. deflorate flower, $\times 5$; q. stamen, $\times 15$; r. style, $\times 5$; s. nut, $\times 15$. j. from *Smitinand* 4642, k—s from *Smitinand* 3987.

littorale: *Pételot 5329* (P); Thuy Trieu, 30 km au sud de Nha trang, végétation step-pique des sables littoraux: *Schmid 765, 3005, 3013* (P).

16. *Fimbristylis merrillii* Kern, Blumea 8, 1955, 135.

THAILAND. Aran Pratet, in open, low-lying, grassy ground, 50 m: *Kerr 19572* (K).

17. *Fimbristylis trichophylla* Ridl. var. *erecta* Holtt. ex Kern, Blumea 8, 1955, 140.

THAILAND. Peninsula. Surat, Ban Kawp Kep, in crevices of limestone rock, 100 m: *A. F. G. Kerr 13177* (K, L); Surat, Tako, Langsuan, in clefts of limestone rocks, 100 m: *A. F. G. Kerr 11876* (K).

18. *Fimbristylis vanoverberghii* Kük. See Blumea 8, 1955, 127.

BORNEO. Brunei. E. part, Temburong River, near junction with Belalang R., in low mud-sandy bank: *Jacobs 5638* (L).

19. *Fimbristylis yunnanensis* C. B. Clarke, J. Linn. Soc., Bot. 36, 1903, 247. — Deser. emend. — *Sect. Actinoschoenus* (Benth.) Kern. — *Fig. 3, j-s*.

Herba perennis. *Rhizoma* lignosum, modice crassum, breviter repens, surculos breves adscendentes squamis ovatis acutis multinerviis ferrugineis obtectos emittens. *Culmi* erecti, graciles, 4—5-costati, sulcati, laeves, inferne paucifoliati, (20—)50—80 cm alti, $\frac{1}{2}$ —1 mm crassi. *Folia* culminibus breviora, erecta, basi canaliculata, ceterum plana, supra celluloso-reticulata, subtus striata, eligulata, apice acuta, sparse pilosa, usque ad 30 cm longa, 1—2 mm lata, vaginis striatis, dense hispidis, ferrugineis vel castaneis, inferioribus elaminatis. *Inflorescentia* capitata, globulosa, densa, 1— $1\frac{1}{2}$ cm diam. *Bracteae involucales* 2—3, ima foliis subsimilis, inflorescentia longior, patens vel reflexa, 2—3 cm longa, ceterae brevissimae, setaceae; bracteolae squamiformes. *Spiculae* numerosae, stellatim patentes, pro toto caeduae, lanceolatae, compressae, acutae, 3—7-florae, brunneae, 6—8 mm longae, $1\frac{1}{2}$ —2 mm latae. *Rhachilla* recta, late alata, alis brunneis. *Glumae* exacte distiche dispositae, chartaceae, oblique erectae, ovato-lanceolatae, acutae vel mucronulatae, dorso acute carinatae, dimidio superiore pubescentes, nervo unico in apicem excurrente, $4\frac{1}{2}$ — $5\frac{1}{2}$ mm longae; glumae inferiores 3 vacuae, minores, ovatae; gluma suprema sterilis. *Stamina* 3; antherae lineares, $1\frac{1}{2}$ —2 mm longae, connectivo in appendicem brevem subulatam producto. *Stylus* gracilis, triquetrus, ad basin pyramidato-incrassatus, glaber, 3—4 mm longus, stigmatibus 3 quam stylus multo brevioribus. *Nux* ambitu obovata, obtuse trigona, brevissime stipitata, apice indistincte umbonulata, dense verruculosa, primo alba, denique straminea, $1\frac{1}{6}$ — $1\frac{1}{3}$ mm longa, $\frac{5}{6}$ —1 mm lata, cellulis extimis isodiametricis subrotundis.

YUNNAN. Mengtze, 5000 ft: *Henry 11150* (K; type).

N. THAILAND. Chiangmai, Doi Sutep, common in gravelly soil in dry deciduous forest, 600—700 m, Dec. 12, 1957: *Smitinand 3987* (EFD 16097) (BKF, L). Mae Hawng Sawn, common in rocky ground in dry dipterocarp forest, 500 m, July 11, 1958: *Smitinand 4642* (L).

Up till now the only record of this remarkable species was that of the type collection. Clarke very properly observed that it is closely allied to *Fimbristylis thoursii* (Kunth) Merr. (*F. actinoschoenus* C. B. Clarke),

the structure of the spikelet being identical. His short description needed some emendations.

20. *Mapania richardsii* Uitt.

The type of this species, the only collection thus far known, consists of a single detached leaf and a few inflorescences. Excellent, complete material was collected by Mr M. Jacobs in 1958.

BORNEO. Sarawak, 3rd Div., Belaga, Kapit Distr., left side of Rajang, in forest, under 500 m: *Jacobs 5242* (L).

21. *Rhynchospora gracillima* Thwaites. See *Blumea* 8, 1955, 162.

N. THAILAND. Loei, Phu Krading, in savannah, 1300 m: *Smitinand 1939* (L), 5948 (*RFD 21537*) (L).

SUMATRA. Pajakumbuh, Harau canyon, marshes along road Sarilamak-Lubuk Bangku, 500 m: *W. Meijer 5243* (L); Taram, E of Pajakumbuh, sandy marsh, 500 m: *W. Meijer 5723* (L).

NEW GUINEA. Morobe Distr., near Manki village, grassy patches on mountain side, mixed with *Soleria pergracilis*, 4825 ft: *Miss Blackwood 279 A* (K).

22. *Rhynchospora heterochaeta* S. T. Blake.

LESSER SUNDA ISLANDS. Wetar. Tarra, in *Eucalyptus* forest near beach, 5 m: *Bloembergen 3754* (BO, L). Kisar. E. of Wonreli, in secondary growth, 5–200 m: *Bloembergen 3862* (BO, L).

23. *Tetraria borneensis* Kern, *Blumea* 9, 1958, 222.

Among the unnamed *Cyperaceae* in the Bogor Herbarium I found some old, inadequately labelled specimens of this species, collected in the last century by Teysmann and Jaheri.

BORNEO. *Jaheri s.n.*, *Teymann 10998*, 11636 (BO). Sarawak, distr. Baram, Lohok Pasir, in centre of shrub forest in peat swamps, 12 ft: *Anderson 9876* (K, L).

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REVIEWS

W. R. TAYLOR. *Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas* — University of Michigan Studies, Sci. Ser. XXI — Ann Arbor, U.S.A., The University of Michigan Press and Toronto, Canada, Ambassador Books Limited, 1960. IX + 870 pp., 14 textfigures, 80 plates. Price \$19.50.

The enumeration of about 760 species and 140 varieties and forms of marine algae growing along the eastern coasts of the tropical and subtropical parts of America, and belonging to the *Chlorophyceae*, *Xanthophyceae*, *Cryptophyceae*, *Chrysophyceae*, *Phaeophyceae*, and *Rhodophyceae*, is preceded by an historical review of collecting and knowledge of those algae. One new family, *Wurdemanniaceae*, eight new species of the genera *Caulerpa*, *Dictyota*, *Dictyopteris*, *Padina* (by Thivy), *Cryptonemia* and *Ceramium*, and four new varieties belonging to the genera *Dictyota*, *Galaxaura*, *Rhodymenia*, and *Herposiphonia*, have been described. Several formae are only marked as such, but not given a name. A number of new combinations are found all through the systematical part of the book. Though this book contains a great quantity of information about the marine algae from the coasts of Bermuda and North Carolina up to that of southern Brazil, the author does not claim monographic completeness. Doubtful records remain for further investigation.

A short chapter on geographical distribution is included, as well as an extensive one on the habitats of the algae, illustrated by 14 photographs from Bermuda and Jamaica. The last mentioned chapter contains an elaborate description of the algal vegetation in all its variations in the territory dealt with. Moreover, it gives many practical indications for effective ecological studies. At the end an explanation of the "Sargasso Sea" is found.

Collection and preservation of marine algae in the tropics are amply discussed. The author made extensive collections himself on the coasts of Dry Tortugas (Florida), Bermuda, Jamaica, Panama, Netherlands Antilles, and Venezuela. It is very useful that such details as the most suitable equipment, the clothing, and hazards which may be avoided, are included. Even those who are used to collecting will find many valuable advices.

The systematical part contains keys to families, genera, and species. Descriptions are added to all the taxa. The distribution of the species restricted to the islands and the states, together with ecological data, as well as references to the literature are mentioned. *Enteromorpha micrococca* Kütz. is kept in that genus, as well as separate from *E. minima* Naeg. ex Kütz., which is a different view both from Kylin's, who placed the first named species in a separate genus *Blidingia*, and from Bliding's, who brought *E. micrococca* Kütz. (1856) to the synonymy of *E. minima* Naeg. ex Kütz. (1849). A character considered by Bliding of high value to distinguish the species in a certain group in *Enteromorpha*, viz. the number of pyrenoids in the cells, has not been used in the key to that genus, nor in the descriptions. *Enteromorpha plumosa* Kütz., *E. erecta* (Lyngb.) J. Ag., and *E. clathrata* (Roth) J. Ag. are kept separate, which view differs from that of Bliding, who combined these species under the name of *E. clathrata* (Roth) J. Ag. *Chaetomorpha linum* (Müll.) Kütz. is kept separate from *Ch. acera* (Good. ex Dillwyn) Kütz. Regarding these species T. Christensen (1957) meant to have proved that the second mentioned one is the attached form of the first one.

The bibliography contains 25 pp. of references, the index 43 pp. of names of genera, species, varieties and forms.

Most of the 74 plates show 2 to 18 very fine drawings by six different artists, amongst whom is the author himself. They are a welcome addition to the descriptions of the taxa and show to full advantage on the paper used. The last six plates are good photographs.

In this beautifully edited, richly illustrated book the author not only compiles our knowledge of the marine algae of the eastern tropical and subtropical coasts of America, but he also adds a great deal to it. This very valuable book will certainly stimulate the study of marine algae all along the tropical and subtropical coasts everywhere.

J. TH. KOSTER

C. LINNAEUS, Genera Plantarum ed. V. 1754. Facsimile reprint 1960. With an introduction by W. T. Stearn. *Historiae naturalis classica IV*. Ed. J. Cramer & H. K. Swann. Wheldon & Wesley Ltd., Codicote, Herts. pp. (xxiv), xxxii, 500, index, add. Clothbound £7.5/- or US \$21.—.

With the rapid increase of scientific institutes a need has been felt for the facsimile reprinting of certain classics and although earlier facsimile editions of the present volume have been published — the last one being the excellent Japanese edition of 1939 — it has been included in this new series.

The editors have been wise to ask Mr Stearn to write an introduction, "Notes on Linnaeus's *Genera Plantarum*", which is most useful for all those who will consult this work which, through its accepted connection with the *Species Plantarum*, is basic for phytophraphy and botanical nomenclature.

This introduction contains the following sections: (1) "Generic names and concepts to the time of Tournefort and Linnaeus" in which the gradual growth of the generic concept in botany is described; (2) Typification of Linnaean genera; (3) The Linnaean sexual system of classification; (4) Key to the classes of the Linnaean system, reprinted from Prain (1900); (5) Editions of Linnaeus's *Genera Plantarum*, of which six are enumerated; (6) Linnaeus's abbreviated references, a most useful list, as these abbreviations are not entirely consistent and extremely concise; (7) A bibliography of references to Stearn's commentary.

Stearn's notes are a most helpful addition and provide a historical background which will prove valuable in evaluating and typifying Linnaean genera.

On the binder is printed "*Hist. Nat. Class. IV*", but on the title page it reads *tomus III*; the latter is probably a printing error. The printing and binding are good. It is, however, regrettable that the enormous price is prohibitive for most individual botanists.

C. G. G. J. VAN STEENIS.

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to Vol. X

compiled by

D. N. F. KIEHL

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